**UNIVERSITY OF OSLO**

**Department of Informatics**

# Challenges and Approaches to Scaling and Standardizing Health Information Infrastructure in Developing Countries: Case Studies from Ethiopia

Masters Thesis

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**August, 2005**

# CHALLENGES AND APPROACHES TO SCALING AND STANDARDIZING HEALTH INFORMATION INFRASTRUCTURE IN DEVELOPING COUNTRIES: CASE STUDIES FROM ETHIOPIA

**THESIS SUBMITTED AS PARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE DEGREE "MASTER OF SCIENCE IN INFORMATION SYSTEMS" AT THE DEPARTMENT OF INFORMATICS, UNIVERSITY OF OSLO, NORWAY**

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# Acknowledgements

This thesis is submitted to the Department of Informatics at the University of Oslo as partial fulfillment of the Masters degree in information system

We first of would like to deeply thank Sundeep Sahay who, during the several months this endeavor lasted, provided us with useful and helpful guidance and support. Without his care and consideration, this thesis would likely not have been completed. We also like to thank Jorn Braa for commenting the earlier drafts of the document.

We are thankful for all our instructors; Sundeep Sahay, Jorn Braa, Judith Gregory, Jens Kaasbøll and Esselina Macome for providing us with valuable knowledge which forms the base to take up this research. We are also thankful to the HISP Ethiopia team member and the PhD candidate, Woinshet Abdella, for her guidance and supervision during the fieldworks.

The Thursday and Saturday dinner of the Ethiopian students was a source inspiration for drafting the document; thanks all the members for the company and creating a feeling of home, especially Zufan and Birkety thanks for preparing 'firfir' every Saturday

We owe a huge debt of gratitude to the Addis Ababa and Oromia Regional Health Bureau heads, Dr. Eyob Kamil and Dr.Tibebu Shiferaw for initiating HISP in their respective regions. We are also thankful to w/ro Fantu Tsegaye and Ato Giremew, from Addis Ababa Health Bureau, and Dr. Demissie and Ato Tesfaye from Oromia Health Bureau for their support and cooperation with the HISP team during the action research interventions. Furthermore, we are grateful for our research informants from the Federal Ministry of Health and the Addis Ababa, Oromia and Amhara Regional Health Bureaus.

Last but not least we like to thank the HISP support staff: Sulutan, Habtamu and Tadle for filling the gap of information while we were writing the thesis.

Thank you all!!!!

Selamawit Molla and Birkinesh Woldeyohannes

# Abstract

This thesis investigates the challenges of scaling and standardizing Health Information Systems (HISs) in the context of developing countries. This investigation is based on case studies and action research interventions aimed at improving the existing HIS in two regions of Ethiopia (Addis Ababa and Oromia). The study has been carried out as a part of the Health Information Systems Program (HISP) initiative, an international research and development project based in the Informatics department of the University of Oslo.

The study was informed by qualitative methods, and carried out within an action research framework. We employed a comparative case study design to help firstly understand deeply and in a context specific manner what constitutes the challenges of scaling and standardizing, and secondly, to develop inter-case comparisons to identify similarities and differences, and what are the contextual influences contributing to these processes.

Theoretically, we build on the Information Infrastructure (II) perspective, which enables us to view the challenges related to HIS in a broader and more holistic manner than what is allowed through a more traditional lens of Information System (IS). Accordingly, we conceptualise HIS as a Health Information Infrastructure (HII) as it is composed of heterogeneous social and technical components. Specifically, the concepts of installed base and cultivation from II theory provide us with the analytical leverage to understand both the challenges to scaling and standardizing, and also how they can be addressed in practical settings.

We define the scope of the standardising effort to include; data set, data collecting instruments, software system and work practices, and the scope of scaling to include; geographic, functional, learning and experience, and level of use. Through our empirical work in the two regions of Ethiopia; Addis Ababa and Oromia, various challenges to the standardizing and scaling processes were identified. The challenges for standardizing were; a) lack of national level involvement, b) poor culture of information use, c) inadequate public health inputs in the HISP team d) time and logistics constraints e) large geographical size and, f) contextual differences in the health systems. In order to address the challenges of standardizing we used strategies of modularization, evolutionary prototyping, user participation and incremental approaches.

With respect to the process of scaling, we identified the following set of four key challenges: a) uneven infrastructure development b) varying management commitment c) the presence of legacy IS d) large geographical size, and, e) differences in organizational structure and functional requirements. The cultivation approach for addressing the scaling process was through the use of gateways, flexible and simple system, as well as an incremental approach as was the case for the standardizing process.

The research contributed theoretically to IS research by emphasizing the interrelation and the associated dilemmas between scaling and standardising. We identified three sets of dilemmas: how standardizing can support (or not) the scaling efforts; how scaling can support (or not) the standardizing effort; and the political implications of scaling standardized solutions.

## A c r o n y m s

| | |
|---|---|
| AACGHB | Addis Ababa City Government Health Bureau |
| ANT | Actor Network Theory |
| ARI | Acute Respiratory Infection |
| CDC | Centre for Disease Control |
| CDD | Childhood Diarreahal Disease |
| CSA | Central Statistics Authority |
| DHIS | District Health Information System |
| EICTDA | Ethiopia Information Communication Technology Development Authority |
| EPI | Expanded Programme for Immunization |
| EPR | Electronic Patient Record |
| ESHE | Essential Health Service for Ethiopia |
| HII | Health Information Infrastructure |
| HIPDT | Health Information Processing and Documentation Team |
| HIS | Health Information System |
| HISP | Health Information System Program |
| HMIS | Health Management Information System |
| HSDP | Health Sector Development Programme |
| ICD | International Classification of Diseases |
| ICT | Information Communication Technology |
| IDSR | Integrated Disease Surveillance Report |
| II | Information Infrastructure |
| IMCI | Integrated Management of Childhood Illness |
| IS | Information System |
| IT | Information Technology |
| LAN | Local Area Network |
| MCH | Maternal and Child Health |
| MM | Morbidity and Mortality |
| MOH | Ministry of Health |
| MOU | Memorandum of Understanding |

| | |
|---|---|
| NGO | Non Governmental Organization |
| NTLCP-MIS | National Tuberculosis and Leprosy Program-Management Information System |
| ORHB | Oromia Regional Health Bureau |
| PHC | Primary Health Care |
| RHB | Regional Health Bureau |
| SHD | Sub-city Health Department |
| SNNPR | Southern Nation Nationalities and Peoples Region |
| TB | Tuberculosis |
| TLS | Total Length of Stay |
| TTBA | Traditionally Trained Birth Attendants |
| VCT | Voluntary Counselling and Testing |
| WerHO | Wereda Health Office |
| ZHD | Zonal Health Desk |

# 1 INTRODUCTION

This thesis investigates the challenges of scaling and standardizing the Health Information Systems (HISs) in the context of developing countries. This investigation is based on case studies and action research interventions aimed at improving the existing HIS in two regions of Ethiopia (Addis Ababa and Oromia). The study has been carried out as a part of the Health Information System Program (HISP) initiative, an international research and development initiative based in the Informatics Department of the University of Oslo, Norway. The aim of HISP is to develop sustainable HIS in developing countries through building local professional and technical capacities within the context of a global research and development network. The authors of the thesis are members of the HISP initiative ongoing in Ethiopia, and the thesis contributes to the action research efforts both within Ethiopia, and also globally.

This chapter is structured as follows. In section 1.1, we introduce our research motivation, which concerns understanding and addressing the challenges of scaling and standardizing of HIS in the context of developing countries more broadly and in Ethiopia in particular. In section 1.2, we introduce the research domain of HIS in developing countries and position our investigation into scaling and standardizing within existing debates and challenges identified by researchers. This discussion leads to the articulation of our theoretical basis in section1.3 to guide the research investigation. This is followed by a summary of the empirical basis and the research approach adopted in section 1.4. Sections 1.5 and 1.6 present the expected contributions of the thesis and the structure of this document respectively.

## 1.1 Research motivation

Health systems, whether in developed or developing countries, rely fundamentally on effective and efficient HIS to get reliable and timely information to support its functions revolving around health services delivery (RHINO, 2001). An effective HIS should principally provide information which allows managers to analyze current situations, identify immediate problems and find solutions. HIS should allow managers to discover trends and patterns so that they can formulate appropriate goals and objectives for the future, and to make intelligent choices about using scarce human, financial, and material resources. An example for the use of HIS to assist managerial decision making activities can be taken from the use of Geographic Information System (GIS) in the World Health Organization (WHO) guinea worm eradication program in 16 sub-Saharan countries (Sauerborn and Karam, 2000). The application involved making overlays of access to safe water on maps of guinea worm prevalence, which assisted programme managers in planning safe water access for population with a high prevalence of guinea worm during that eradication program.

The need for strengthening HIS in developing countries has now found voice through various means including national policy statements, strategies of international funding agencies, and the writings of researchers, like ourselves, studying HIS. Strengthening of HIS is being recognized to be a fundamental requirement for functioning of the overall health system. Various examples can be seen in both the academic literature and popular press about ongoing examples of attempts to strengthen HIS. For instance, the government of Ecuador, through the funding of the International Development Agency, initiated an effort to decentralise and modernize the health management, including the HIS, in the health districts of the country to support the primary health care service (Salazar, 2004). Similarly, there are also ongoing attempts to strengthen HIS in different countries such as Mozambique, India, Zambia, Nigeria, Cameron, Tanzania (Puri et al., 2000, Chitah and Bossert, 2001, Hutchinson, 2002). The Ethiopian Federal Ministry of Health(MOH) has also made a recent call for consultants to help improve the existing

HIS, including the development of national level indicators, design of a software, and capacity building efforts in selected districts (called weredas).

HISP, within which this research is based, is an example of a global effort to strengthen HIS in various developing countries. HISP was initiated in South Africa in 1994 (Braa and Hedberg, 2002). Initially based in the Western and Eastern Cape Provinces, HISP has since evolved into a national level effort. This effort comprises of many facets including the development and deployment of a district based HIS (called DHIS – District Health Information Systems) and intensive and ongoing efforts to support capacity building of the health staff to strengthen local use of information for action and planning. These efforts are strengthened by ongoing educational efforts through doctoral and masters studies run in collaboration between the Universities of Oslo and Western Cape. Since its initiation in South Africa, HISP has been extended to various countries, including India, Mozambique, Tanzania (both in the mainland and Zanzibar), Malawi and Vietnam. The ongoing HISP initiative in Ethiopia provides the umbrella within which this research is situated.

In trying to strengthen HIS, many developing countries, including Ethiopia, are in the process of attempting to introduce Information Communication Technologies (ICTs) to both automate and make efficient existing routine reporting systems, but also to make visible patterns in the health information which were typically invisible in the manual systems. For example, the use of computer based systems allows for data to be entered at the point where it is collected, the generation of reports and their transmission to the higher levels. However, unlike in the computer system, in the manual systems, data are aggregated and people at the higher level could not see the disaggregated data. For example, as reported by Braa *et al.* (2001) from their study in Mozambique, managers at the province level could only see district level data and not that of the peripheral health facilities, which is crucial for action and planning. Computer based systems technically allows the people at the top to drill down to the lowest level. For example, with the computer system, the manager can potentially identify which particular health facility is

having a problem (rather than a district) and thus plan for more effective and focused interventions such as the delivery of drugs.

Recognizing this potential of ICTs, various national, regional and local governments, in both developed and developing countries are taking initiatives to introduce ICT to strengthen HIS. These include a wide variety of technologies. For example, Aanestad and Hanseth (2003) report on the implementation of a broad band multimedia technology (telemedicine) to be useful for the transmission of information in image and sound form to the users of the system. They further discuss how this technology allows collaboration among medical personnel with out space and time limitations, and that facilitates surgery related activities in a Norwegian hospital.

Despite these widespread efforts to introduce ICTs, and the significant investments of time and money, it has been argued by researchers that the practical benefits of the technologies to health care management remain largely unrealized (Heeks, 2002, Sahay 2001). Repeatedly, failure stories are reported about the development and implementation of HIS in developing countries (and also in the developed world). Heeks (2002) has identified four types of Information System (IS) project failures; total, partial, sustainable and replication. Heeks calls a system as totally failed when it is never implemented after its design. Partial failure refers to a system which could not achieve its goals once it is implemented. The third type of failure is of sustainability, which is mostly seen in developing countries. In this case, the new system is implemented and performs for a relatively short period of time and fails after a year or so due to different constraints. The replication failure comes when a system fails to be scaled to other sites from the pilot site. Our thesis especially focuses on this challenge of replication, and the inability of the HIS to be able to provide full coverage of data to the health planners.

In recent times, various research studies have been undertaken to identify reasons for why computer based HISs are not delivering the promised potential in various developing country settings. The significant involvement of donor agencies and the dependencies

that creates in the host nation, the existing poor infrastructure (both physical and digital), and the inherent complexity of the HIS are amongst the reasons identified for this poor performance (Mosse and Sahay, 2003, Braa et al, 2001, Heeks and Baark, 1999, etc). For example, in Mozambique, the development of district based HIS through the HISP initiative has not achieved to desired levels due to inadequate infrastructures (insufficient computers), lack of trained personnel, absence of technical support, and communication related challenges (Mosse and Sahay, 2003, Braa *et al*, 2001).

As is reflected through the above example of Mozambique, the reasons underlying the unfulfilled potential are largely related to social, political, cultural and organizational challenges. In more recent research, the socio-technical issues of scaling[1] (see for example Sahay and Walsham, 2005, and Braa, Monteiro and Sahay, 2003) and standardizing[2] (see for example, Braa and Hedberg, 2002) have been identified as being fundamental challenges that implementing agencies need to address in order to develop effective, reliable, and sustainable HIS. The concept of scale in the context of HIS refers to the expansion of an artefact , a system, 'best practices' or procedures and routines for use from a certain point of its origin to both vertical levels (for example, from facility to district to province) and horizontally (for example from one district to another). Scaling, thus, refers to the socio-technical processes through which there is an increase both in the numbers and also the sophistication and maturity of the users, the functionality of the system, and also the levels of use (Sahay and Walsham, 2005). Practically, the importance of scaling can be understood from the fact that in order to calculate the immunization coverage for a province, data need to be collected from all the facilities within all the districts of the region – i.e., in full scale. Without the full coverage of scale,

[1] We use the term "scaling" as a verb to deal with the process of increasing the scale of the HIS. The term "scale" is thus used as an adjective to refer to the characteristics of what is being scaled – the HIS

[2]We use the term "standardizing" as a verb to deal with the process of creating standards around the HIS. The term "standard" is used as a noun to reflect the object that is being standardized – different aspects of the HIS

data collected from isolated and incomplete pockets of facilities or districts, is basically of little use to the planners at the top to plan interventions, such as of outreach supports.

Associated to the problem of scaling, although it has rarely been considered together in the literature, is the challenge of standardizing. Standardizing refers to the process of employing best practice principles and guidelines for the collection and storage of health care data in a uniform manner across various facilities, levels, and programs. Standardizing includes the use of instruments and practices for collection of data, its analysis and transmission. Standards serve as guidelines, principles or gateways for communication among health workers (physicians, nurses etc) and health hierarchies such as, districts, provinces and national (Abdelhak*,* 1996*,* Braa and Hedberg, 2000 & WHO, 2003). The need for uniform standards becomes more intensified and challenging as the system scales in scope because of the involvement of more users with diversified interests. However, at the same time, in applying these standards, there is the need to be sensitive to the differences in the needs of different administrative levels (district, province, and national) and also health programs (for example, HIV, TB, Malaria etc). This gives rise to the dilemma that the existence of standards can, on the one hand, facilitate the incorporation of new users and requirements within a commonly existing template, while on the other hand, very rigid standards can stifle the involvement of new users because of them being insensitive to local needs. Thus, in this thesis we will argue for the issues of standardising and scaling to be taken up in conjunction rather than in isolation.

When these issues are taken up in conjunction, it is possible to identify some associated dilemmas, where each of them both undermine and support the other. The understanding of these dilemmas of scaling and standardizing, and their interconnections, we argue remains largely poorly understood in the IS research domain, a point also argued by Braa, Monteiro, and Sahay (2004). Our understanding of the importance of the topics of scaling and standardizing in both the theory and practice of HIS, and also how poorly it is addressed in the existing literature, provides the key motivation for undertaking this

thesis topic. Our motivation is to contribute to a firmer and broader understanding of the nature of these challenges to the efforts of strengthening HIS in developing countries. We argue, that with out seriously addressing these twin challenges, future efforts to introduce computer-based HIS will continue to yield not so positive outcomes. With this background and motivation, the specific research aims of this thesis are two fold:

1. *To understand the nature of the challenges of scaling and standardizing in the context of HIS in developing countries more broadly, and in Ethiopia in particular, and*
2. *To explore the particular approaches and strategies used to address these challenges, specifically within the context of the health sector in Ethiopia.*

The issues of scaling and standardizing are thus the focus of this research, both in terms of their theoretical understanding and practical strategies to deal with them. More specifically, our focus is on understanding the nature of challenges related to standardising datasets, data collecting instruments, software system and work practices and expanding a system or 'best practices' from one point to another. This research is expected to contribute not only to the ongoing HISP efforts in Ethiopia, but also more broadly to the research and practice of HIS in developing countries.

In the next section, we briefly introduce the domain of our research, HIS in developing countries, and position our research within some contemporary and ongoing debates and challenges identified by researchers.

## 1.2 HIS in developing countries: some key research issues

The domain of HIS in developing countries is increasingly becoming a focus of attention of researchers from all over the world. This attention comes both because of the heightened funding focus that has been accorded to HIS by international and national agencies, and also due to the realization that despite the undoubted potential that ICTs

have to strengthen HIS, this promise remains largely unrealized. Early research in this area has focused primarily on describing in rather utopian terms, the promises of ICTs. For instance, Nilsson, Grisot and Aanestad (2005) have discussed the potential of Electronic Patient Record (EPR) technology in the health care sector as 'not only to improve the old-fashioned, messy and inadequate paper records, but to fundamentally transform and improve medical care' (Nilsson, Grisot and Aanestad, 2005, page 1)

Recent research has started to focus on the analysis of implementation challenges, and reasons underlying the unfulfilled promises of ICTs to health management. The gap between the design of the new ICT based systems and the reality of the implementation context has been emphasised by Heeks (1999) to be a factor to influence successful implementation of HIS. These challenges to HIS implementation have also been identified by earlier research into IS more broadly both in the context of developed and developing countries. For example, Keen (1981) has described how the existing social inertia in a context challenges ICT initiatives. Keen identified the following four causes of inertia; a) poor information use culture, b) the tendency of human beings to rely on their experience to process data and their preference do simple rather than complex tasks; c) the complexity of organizations, and, d) the effect of the new IS on the interests of particular groups.

These various challenges discussed above, and also in the research motivation section, have direct and indirect implications for the scaling and standardizing of HIS, with significant influences on the implementation processes. For example, Mosse (2004) has pointed out four major constraints to HIS implementation in Mozambique; inadequate resources, high workload of health workers, the bureaucratic structure of the health administration, and the fragmenting influence of international funding agencies. These constraints directly influence processes of scaling and standardizing, although Mosse (2004) has not explicitly made this link. For example, the funding efforts of multiple international donor agencies, each focused towards particular programs, contributes to the proliferation of different reporting formats in the health sector which are

counterproductive to the creation of standardized forms. In another case study, also from Mozambique, Chilundo (2004) has described the challenges to integrate the vertically organised line health programs, which are the source of multitude reporting formats, supported by the presence of donor agencies and their diversified interests. Integrating these programs is crucial for health data standardizing, but for various reasons is problematic to achieve. Infrastructural problems also pose significant challenges to system scaling processes. For example, Sahay and Walsham (2005) have described how the problems of poor electricity supply to have hindered the scaling of the DHIS in rural areas of India.

However, despite the direct implications of the adverse conditions identified in the literature to the importance of standards and scale, these topics are rarely discussed explicitly in contemporary IS research. This thesis seeks to address some of these gaps in the literature. In the theoretical chapter (2), we provide a more elaborate discussion on the issues of scaling and standardizing as they have been treated in the literature, more broadly in IS research, and more specifically within the context of HIS in developing countries. In the next section, we provide an overview of our theoretical basis to guide our research investigation.

## 1.3 Overview of theoretical basis

Theoretically, we build on the Information Infrastructure (II) perspective, which enables us to view the challenges related to HIS in a broader and more holistic manner than what is allowed through a more traditional lens of IS. The II perspective represents contemporary thinking within IS research to specifically understand large, complex, and interconnected systems, whose development and use are not in the control of any one person or agency. We argue that the HIS studied in this thesis reflect characteristics of such IIs, and are thus better understood through such a theoretical lens as contrasted to traditional IS research concepts that typically relate to relatively closed and stand alone systems designed to serve a specific group of people. The II perspective adopted draws

upon and also extends concepts from Actor Network Theory (ANT), which have contributed to IS research in the analysis of technology as being constituted in and constituting complex, and heterogeneous socio-technical networks.

Very briefly, we introduce the key idea of II and associated concepts articulated in this theory which helps us to analyze the challenges of scaling and standardizing HIS. II is defined as the interconnection of collection of heterogeneous socio-technical actors that encompasses physical equipments, standards, applications and software, human resource and the information itself (Monteiro, 1998). In contrast to the traditional IS, II is described to be *open*, *shareable*, and *evolving* (Hanseth and Monteiro, 1998). When II is said to be open, it refers to the absence of predefined limits to the number of users and also applications. An II is irreducible, and can serve a number of users at the same time, and this refers to its sharable characteristic. II changes and evolves through time to cope with the constantly changing environment and needs. The Internet is a good example of an infrastructure that reflects these II characteristics. There are no technical restrictions to the number of users who can use the internet infrastructure; both in terms of which part of the globe they belong to and also with respect to what applications they want to use. The Internet has expanded over time through the continuous addition of new functionalities. For example, the recent incorporation of functionalities to support electronic commerce has created technically more features and applications, which has also introduced more diverse users of the Internet.

We argue that HIS can best be conceptualized as a Health Information Infrastructure (HII) as it is composed of heterogeneous social and technical components (such as health planners, physicians, health program experts, government bodies, reporting formats, hardware, software, and work procedures). The information collected through the HII may need to be reported and shared with other sectors, nationally or internationally, for different purposes. For example, the HIV reports from laboratories are compiled and sent to UNAIDS in addition to the local and national health administration.

HIIs are open as they need to cater to an unlimited number of users including health planners, physicians, patients, health workers, and program managers. The openness also refers to the new data collecting and processing tools, and new health programmes that become components of the HII over time. Due to the dynamic nature of the health domain, HIIs need to be constantly changing and evolving over time. For example, new intervention areas may emerge and need to be integrated with the already existing system, increasing the numbers and types of users, and reflecting heterogeneity of the HII.

Specifically, two concepts of installed base (Monteiro, 1998) and cultivation (Dahlbom, *et al.,* 1996) are drawn upon from II theory, which we argue are potentially very useful analytical devices to study the challenges of scaling and standardizing HIIs. The notion of installed base informs us that any process of designing, developing and scaling up of an II cannot be started from scratch, and has to respect the historically existing installed base (for example, the legacy IS, existing reporting formats, work procedures etc.) as a point of departure in the development of the new extensions. Respecting the installed base also cautions against the futility of making drastic changes, as is often argued for by the strong proponents of technology. Understanding this importance of history, requires a paradigm shift in the way we think about design – and to move from the perspective of "constructing" to one of "cultivating" (Hanseth and Monteiro, 1998). Constructing implies that there are predefined users requirements and group of users, and by the application of methodologies like "waterfall" (Somerville, 2001), the system can be best designed. On the contrary, the cultivation approach sees II development to be a long-term incremental strategy with the aim to extend and grow upon an existing installed base rather than to try and radically change it. Cultivation requires a close analysis of the way user behavior is historically inscribed in the already existing elements of an infrastructure, the installed base, and this knowledge is used in the cultivation of the "new" system.

Viewing scaling and standardizing processes from the perspective of IIs implies seeing them not only as technical, but as heterogeneous processes inscribing technical, political, and organizational conditions. These conditions processes have to be changed and

cultivated in small increments while being understanding and sensitive to the difficulties and complexities historically inherent in such a system. In summary, the II perspective firstly, allows us to develop a broader and more holistic understanding of HIS as conceptualized as HII. Secondly, the concepts of installed base and cultivation provide us with analytical leverage to understand both the challenges to scaling and standardizing, and also how they can be addressed in practical settings.

## 1.4 Overview of the empirical basis and the research approach

The research was carried out in a team of two researchers, who are the authors of this thesis. We joined the HISP team in July 2003 when we were recruited to attend the two-year Masters program at the University of Oslo. Since then we have been working together in the two (Addis Ababa and Oromia) regions of Ethiopia to improve the existing HIS under the umbrella of the global HISP. In this thesis, we report from these experiences.

Since our research focus was to firstly develop a deep and context specific understanding of the challenges of scaling and standardizing of HII, and secondly, to try and address these challenges in the context of Ethiopia, we adopted a comparative case study design approach. This study was informed by qualitative methods, and carried out within an action research framework. The comparative case study design, carried out in two regions in Ethiopia, helped firstly to understand deeply and in a context specific manner what constitutes the challenges of scaling and standardizing, and secondly, to develop inter-case comparisons to identify similarities and differences, and what are the contextual influences contributing to these processes.

The qualitative methods employed in this research were in line with the socio-technical systems perspective where technology was seen embedded in a web of socio-technical relationships comprising people, organizations, practices, artifacts, social relationships and technology. Qualitative methods, carried out through interviews, observations,

participatory workshops and analysis of secondary material, helped to understand from the perspective of the people and the organization, the web of these socio-technical relationships and how they were changing over time. Developing this situated understanding would have been largely not possible through quantitative approaches comprising of surveys with a focus on measurement and hypothesis testing. However, though not extensively, we also used quantitative methods to complement the findings we got through qualitative methods, such as through the survey on the number of computers in the region.

Since our focus was not only on understanding, but also on influencing change, we adopted an action research approach. Such an approach is in line with the broader HISP approach globally, which in a recent paper has been described as "networks of action" (Braa, Sahay and Monteiro, 2003). This approach focuses on developing, implementing and reflecting on interventions which aim to support the sharing of experiences, ideas, and artifacts, both vertically (within countries) and horizontally (across countries) in the network. We draw upon and adapt these ideas to our particular setting where the vertical refers to within a region, while horizontal refers to the different regions in Ethiopia. The "networks of action" that we were concerned with include the sharing and adaptation of data sets, software, training material, and processes of technical support.

The field work was started in Addis Ababa in January 2004, by conducting training and system installation in Sub-city Health Departments (SHDs) followed by adapting the Addis Ababa database to the local context of Oromia. Adapting the DHIS software according to the needs of particular regions, preparing a user manual, conducting training, installing the system, and maintaining various discussions with the Regional Health Bureaus (RHBs) were the major tasks undertaken by us throughout the fieldwork. Our case study findings also received inputs from the results of a preliminary assessment of the HIS conducted by the HISP team, including us, in July/August 2003. The assessment was carried out in four regions of Ethiopia (SNNPR, Oromia, Addis Ababa, and Benshangule-Gumuz). However, our research has focused primarily on two research

sites; Addis Ababa and Oromia. In addition, we also initiated the HISP processes in a third region of Amhara, which we do not discuss as a separate case study, but draw upon some of the experiences there to discuss the scaling and standardizing challenges in the analysis chapter (7).

## 1.5 Expected contributions of the thesis

The thesis aims to contribute both to theoretical and practical knowledge concerning the design, development and implementation of HIS in developing countries, with a focus on Ethiopia. More specifically, we contribute theoretically by developing a deeper understanding of the challenges of scaling and standardizing, drawing upon an II perspective. These challenges have been identified by contemporary research as being very important more broadly (to the IS community) and in relation to HIS in developing countries in particular. Our thesis contributes to this gap in theoretical knowledge, by more specifically arguing that scaling and standardizing are not only about technical issues, but also fundamentally about the work practices, reporting formats, data elements, in addition to the software, that are all products of and embedded in a historical context.

Practically, we argue that addressing these twin challenges of scaling and standardizing can contribute to the development of a functional and standardized system that can more broadly support the ongoing efforts of the Ethiopian authorities to develop a national level HIS. Developing a national level HIS is fundamentally about dealing with the problems of scaling and standardizing, we argue in this thesis.

## 1.6 Structure of the thesis

After this introduction to the various facets of the thesis, the rest of the document is organized as follows. The second chapter presents the theoretical perspective developed around the concept of II. The research approach is presented in the third chapter, followed by a description of the research context in the fourth chapter. Chapter five, the

case study description, is organized in three sections: the current HII situation at the national level; and the situation analysis of the existing HII in Addis Ababa and Oromia regions respectively. Chapter six presents the action interventions carried out in the two regions based on the situation analysis (presented in chapter 5), and the observable outcomes of these action, and the reflection and evaluation of them. In chapter seven, we present the analysis and discussion of the empirical materials by drawing upon our theoretical perspective (described in chapter two), and positioning our findings within some of the wider debates in the IS literature relating to scaling and standardizing. The last chapter (8) presents some brief concluding remarks, including key contributions of thesis, and the identification of some areas for further research.

# 2 THEORETICAL PERSPECTIVE

## 2.1 Introduction

In this chapter, we present the theoretical perspective that we use to both conduct the empirical work and also to analyse our findings. We start by emphasizing the importance of a socio-technical perspective to IS development and implementation (in section 2.1), and trace how such a thinking has evolved over time starting with socio-technical approaches such as web models to ANT and now contemporary thinking around II theory that specifically is being developed by researchers to aid the analysis of large scale and complex systems. We further present the importance of a socio-technical perspective in IS development and implementation in section 2.2. In section 2.3, we present the II perspective, and draw upon some key concepts relevant to our analysis. In section 2.4, we argue why HIS are best understood as IIs. In the 'proposed theoretical perspective' section (2.5), we summarize our discussion by emphasising the key concepts that we use as analytical framework for our empirical material.

## 2.2 Importance of socio-technical perspective in IS development

Early research in ISs in the 1970s and early 1980s was influenced broadly by a computer science tradition, which adopted a predominantly technology deterministic perspective. During this period, significant importance was attached to the potential of computers to bring about radical organizational changes, create expert systems and robotics, and even replicate the human brain.

However, during the later part of the eighties, it started to become increasingly evident that the promises that surrounded computers have remained largely unfulfilled, and despite the increasing levels of investments into technology, the perceived benefits being experienced by individuals and organizations was relatively minimal. Researchers started

to criticize this technology focused approaches and emphasized the need to analyze the role of the organizational context in shaping these outcomes. This led to the increasing acknowledgement of the paramount importance of a socio-technical perspective, and identification of various organizational issues (such as top management support, rules, culture, commitments) and human factors (such as training) that influence implementation.

An early and influential socio-technical approach applied to IS research was that of the web model proposed by Kling & Scacchi (1982). The aim of the web model was to better understand the connection of the technology with its social and political context understood as a socio-technical web of equipment, people, techniques, rules and norms of the organization. As opposed to discrete-entity model (which focuses on the technology and largely ignoring the social context), the web model emphasized the importance of the social context around the computer system; for example, the potential actors, the available infrastructure that supports the system, and the organizational history, all of which significantly influence the development and use of the computer-based IS.

The web model has been applied in various technology mediated settings. For example, Braa and Nermunkh (1997) use this model to unpack the problems of improving HIS in Mongolia. They argued that the policy makers are mostly restricted to the technical aspects (as presupposed by the discrete -entity model) giving insufficient attention to the wider health sector reform (e.g. coordination of the vertically organized programs) which significantly impact upon efforts to bring about better governance, use of information, and informed decision making.

While the web model was seen as an important first step in the development of a socio-technical systems perspective, it was also seen as being rather static and of taking the context as being given (Sahay and Walsham, 1996). To further develop this perspective, some IS researchers (for example, Orlikowski 1992, Walsham 1993) started to adopt other social theories such as Structuration to explore the relation between the social

context, the process of implementation, and their mutual interrelationship. The use of such theories also helped to develop more process oriented approaches to study the relationship between technology and organizations. For example, Structuration theory recognizes that human actions are enabled and constrained by structures, yet that these structures are the result of previous actions (Orlikowski, 1992). Recognizing its importance, there have been many attempts by researchers to apply Structuration theory to particular empirical situations. For example, Orlikowski (1992) interpreted the use and adoption of information technology in a large multinational software consulting firm, Beta Corporation using Structuration theory. In 1987, Beta had over 13,000 consultants who were engaged in "functional" and "technical" tasks in developing application systems, in research activities, and providing support in over 50 countries. The development of tools within Beta were controlled and constrained by its structure as is described by Orlikowski as follows.

> Commissioned by senior management, technical consultants were influenced in their development work by their managers' strategy. This management strategy authorized the allocation of resources to technical consultants facilitating their construction of tools. This construction was also influenced by Beta's extant systems development methodology which provided the interpretative schemes and norms that technical consultants drew on to develop the productivity tools (Orlikowski, 1992, p. 414).

While the earlier IS research on implementation was focused more in the context of the developed world, since the late eighties and early nineties, there has been a steadily increasing research focus on implementation also in the context of developing countries. Various researchers, such as Walsham (1998) have emphasized the significance of a socio-technical perspective on IS also in the context of developing countries. Walsham *et al,* have argued as follows:

> The problems of IS development and use are often more severe in developing countries in terms of factors such as the current state of knowledge, availability of suitable equipment and infrastructure, lack of financial resources, shortages of technically competent personnel and constraints imposed by the social and political context (Walsham *et al*., 1988, p.190) .

Research in the context of IS and developing countries have also applied Structuration theory to study implementation challenges. For example, Walsham and Sahay (1996) use Structuration theory along with ANT to investigate problems in developing GIS in an Indian government department. They argued that the scientific traditions prevailing in the remote sensing institutions and also the governmental bureaucracy shaped the project related action, such as the willingness of government departments to share maps between each other, and also of individuals (such as forest officers) to take proactive decisions. They also argued that the largely absent culture of using maps in government departments also contributed to form some kind of resistance towards the use of GIS technology. In this way, they unpacked what elements of the structure shaped project level action and they emphasized theoretically and empirically their mutual inter-relationship.

Despite its increasing application, Structuration theory has been also criticized by certain researchers for not "taking technology seriously" and treating it like a black box (Hanseth and Monteiro, 1995). They argue that the technology has material features which in itself can constrain or enable social action, thus it is important to unpack the technology in a deeper degree of granularity than is typically done by researchers. They explain what is lacking in using Structuration theory and the promises of ANT as follows:

> ….most studies conducted so far (Korpela 1994; Orlikowski 1991, 1992; Orlikowski and Robey 1991; Walsham 1993) [using Structuration theory] are lacking in describing, with a satisfactory level of precision, how specific elements and functions of an IS relate to organisational issues. We also suggest that the framework provided by actor-network theory (ANT) is more promising in this regard (Hanseth and Monteiro, 1995, p.1)

Various researchers have tried to address this criticism about not taking technology more seriously through the use of ANT which conceptually provides a symmetrical status to technology and the social in describing the technology-organization relationship (see for example, Hanseth, Aanestad and Berg, 2004, Lee, 2001). In ANT, an actor-network is described as consisting of heterogeneous technical and non-technical elements that are interlinked (Latour, 1987, Callon, 1991). Viewed as a heterogeneous network, ANT

argues that the social and the technical cannot be seen without each other in isolation. According to Latour (1987), many actors make up a network of interests which becomes stable as they are aligned to the technology. This alignment is achieved through the translation of interests and the enrolment of actors into the network. Translating involves showing how an actor's non-aligned interests may become aligned. Skills, practices, organizational arrangements and contracts need to be all part of this process of alignment.

IS researchers have applied ANT as an approach to explain the links between society and technology. For example, Aanestad (2003) viewed the technology and associated work practices as constituting a heterogeneous actor-network during the introduction of multimedia communication technology (cameras, microphones and loudspeakers) into a surgical operating theatre of a national hospital in Oslo. In her research, she emphasized the use of a cultivation approach to design which recognizes the interconnection between the various social and technical elements of the telemedicine network. Braa and Hedberg (2002) have also used ANT to describe the influence of key actors in the process of standardizing data sets and designing a computerized HIS for the South African health care sector. In their case, they demonstrate how the diversified interests of users were aligned during the standardizing process using a flexible system in order to facilitate the translation process.

A further development and extension to ANT is provided by the II perspective which has been proposed by researchers like Hanseth and Monteiro (1998) to specifically discuss and analyze the issues around the design and development of complex networked systems like the internet. In this thesis, we argue that HIS are best understood as HIIs as they represent characteristics of II. II theory provides us with interesting concepts such as installed base and cultivation that specifically are useful to analyze processes of scaling and standardizing in the context of complex and interconnected systems such as for health care. In the next section, we first elaborate on the key principles underlying II theory, and also the main concepts that we draw upon for our analysis. Following this, we argue for the conceptualization of HIS as HII, because of the very characteristics of

HIS. Following this, we propose our theoretical framework based upon the II perspective to analyze the challenges of scaling and standardizing.

## 2.3 The Information Infrastructure perspective: key concepts

Information Infrastructure theory is a body of research that is increasingly being drawn upon by researchers to analyze complex, inter-connected and networked systems that are characteristic of contemporary processes around globalisation. IIs are different from IS, which typically refer to stand alone systems, that are designed for a single or small group of users. Hanseth and Monteiro (1998) explain the usefulness of the concept of II over the traditional IS as follows:

> [The] traditional approaches of IS are implicitly based on assumptions where the information systems are closed, stand-alone systems used with in closed organizational limits……. When developing infrastructures, the focus on closed, stand-alone systems has to be replaced by one focusing on the infrastructures as open and global…… (Hanseth and Monteiro, 1998, p.4 & 5)

II is characterized by six key features, which Hanseth and Monteiro (1998) argue in making it different from IS. These features are: heterogeneity, socio-technical nature, enabling, shared, open and evolving. IIs are heterogeneous socio-technical networks as they are linked with different technical and non technical components of varying types (for example, people, work procedures, software, hardware etc).The heterogeneity feature of IIs is also related to the fact that they are layered up on each other and that the seemingly same functions might be implemented in several different ways. The absence of limits for number of users, stakeholders, and vendors involved in different nodes in the network and other technological components, application areas, network operators, make the infrastructure to be open and contributes to its heterogeneity. An infrastructure is shared by the members of a community in the sense that it is the one and the same single object used by all of them (although it may appear differently to the various actors). The last aspect of infrastructures which makes them different from IS are its supporting and enabling functions for a wide range of activities, not especially tailored to one. For IIs to

function smoothly, all the components must be convergent and aligned. In technical terms, this means creating and implementing standards. Communication among the various components must take place according to shared, standardized protocols. However, standards are more than just the technical protocols, but also involve aligning of the management practices (Sahay, 2003).

Hanseth and Lundberg (2000) conceptualize the Internet as an II as it displays infrastructural characteristics that are stated above. The Internet, being composed of heterogeneous components (for example, the global TCP/IP network, email, news, users etc) is a shared resource for heterogeneous actors (from different disciplines and various corners of the world) as all data are transferred through the same network (although not exactly the same node). Further, if one user sends a large volume of information, this might jam the network and cause problems for other users. It is open in the sense that there is no limit to the number of components (both human and non human) to be added on to the network. For instance, infrastructures supporting electronic commerce are built on top of and integrated with the already existing internet infrastructure to attest to the evolving nature of infrastructures.

IS researchers, have in recent times, started to apply the II perspective to the analysis of various ICTs in different organizational settings. For example, Aanestad (2002) draws upon II concepts for the analysis of a telemedicine application within a Norwegian hospital. The telemedicine is conceptualized as a heterogeneous socio-technical network comprised of computers, microphones, loudspeakers, digital cameras, medical devices, general practitioners and specialised physicians who generate, use, transmit and share information. This II enables communication for different domains of health care (such as radiology, surgery, medical consultancy and distance medical education) with no limits on the number of users or user groups to join and draw upon the benefit of the infrastructure .The fact that the same telemedicine can be used by different users for various purposes makes it a shared resource for a multiplicity of user groups. For example, the general practitioner, who works in the remotest place, can use the

telemedicine infrastructure to get help from specialized physicians who work at various places in the world by only sending medical results and history of the patients. Simultaneously, health professionals can use the same infrastructure to easily communicate with each other, get updated information, share their experiences and develop their capacity. On the other hand, patients use the telemedicine infrastructure to get health services by being able to communicate with remotely located specialists.

The concept of II has also been used by many IS researchers to unpack and better understood the complexities inherent in the design and implementation of an EPR system in large hospitals. For example, Nilsson, Grisot and Aanestad (2005) and Ellingsen and Monteiro (2003) use the II concepts to study the complexity and the interconnected nature of EPR which makes it difficult to change. Building up on the II perspective, the EPR II consists of heterogeneous components such as computer, applications, software, clinical databases, physicians, health professionals, patients, and medical histories. EPR serves as a shared infrastructure for a large group of users such as research and education people, management bodies, medical personnel, patients to access updated information, and for the health staff to provide better health services. It is open to incorporate new medical personnel, patients, facilities, and applications to it. Accordingly, the EPR might be extended by adding new procedures for possibly making new diagnoses as new illnesses and diseases are discovered through time.

The above examples illustrate how II concepts have been drawn upon by researchers to develop a broader perspective of complex and interconnected socio-technical systems, which would have been difficult to analyze through traditional IS related theoretical lenses. Two concepts from II are particularly relevant to our analysis of scaling and standardizing related to installed base and cultivation. These are discussed below.

**Installed base:** as discussed above, the various components of an II are interconnected and that the development of a new one cannot be done from scratch and also cannot be achieved instantly. Rather, it takes time, depending on the already existing old

infrastructure; the installed base. Hanseth and Monteiro (1998) explain the role of the installed base in building an II as follows:

> The focus on infrastructure as "installed base" implies that infrastructures are considered as always already existing, they are NEVER developed from scratch. When "designing" a "new" infrastructure, it will always be integrated into and thereby extending others or it will replace one part of another infrastructure (Hanseth and Monteiro, 1998, p.148)

As stated in the above quote, infrastructures develop through extending and improving the *installed base*. For example, this was the case in building of EPR system. The new EPR was built by improving the paper-based system and also the situated work practices, for example the processes around how data was registered (Nilsson, Grisot and Aanestad, 2005). Accordingly, the installed base influences and shapes the evolution and implementation of the new system. The path dependency (i.e. how past events impact future development) creates a 'lock in' situation. A lock in situation is one when a technology has been adopted, it becomes nearly impossible to develop and make usable the competing technologies as users have already established their preference for the already existing technology (Arthur,1998). The notions of 'path dependency' and 'lock in' are important concepts to explain the impossibility of bringing radical change to an existing installed base. 'Network externalities' (Katz and Shapiro, 1986) is also another complementary concept to explain the resistance of the installed base to change. The term denotes the fact that such phenomenon can happen on aspects external to technology itself (for example, the growing number of users). As the numbers of users grow, reaching agreement about new features of II as well as coordinating transitions becomes increasingly difficult (Hanseth and Monteiro, 1998). Also, as there is a growth in users, it makes it look attractive for other users to also join the infrastructure.

**Cultivation:** Cultivation (Dahlbom, *et al.,* 1996) is also suggested by Hanseth and Monteiro (1998) to be appropriate for II development as opposed to the notions of design or construction which was applied in traditional IS development. The traditional software development approaches such as the waterfall method requires the detailed and full users'

requirements and the system development follows predefined steps, such as requirements analysis, coding, testing, evaluation, which is referred to as the process of construction (Sommerville, 2001).

In contrast, cultivation refers to a slow incremental process of transforming the installed base (Braa and Hedberg, 2002). Cultivation presupposes that learning involves at least two key aspects: of the context of the technology by the developers; and, the technology by the client organization. It can be argued that it is the interplay of these two which can bring about piecemeal improvements or extensions of the installed base over a sustained period of time. Although not explicitly said, many IS researchers have used different strategies and methodologies to 'cultivate the installed base'. For example, Hanseth and Lundberg (2000) in their study of hospitals in Sweden have explained the radiological II to be linked together through long chains of actors including their work practices. They suggest the use of gateways/standards as an interface between the different components of this chain – the new electronic network and the larger and older actor network, the installed base, to extend one version of the infrastructure into an improved one. This is also related to what Hanseth and Monteiro (1998) have described as the modularization approach, which is used to divide an infrastructure into smaller unit (modules) based on their use or user groups and building one up on the other. This approach is said to facilitate the flexibility of extending or improving infrastructures (Hanseth and Monteiro, 1998). The different modules can be interconnected using gateways which are standardized solutions to connect separately developed, and 'should work together' to satisfy the broader needs of the users.

Drawing upon empirical evidence from a Norwegian hospital, bootstrapping (a process of making a tool by means of the tool it self) has been discussed by Hanseth and Aanestad, (2003) as a strategy to cultivate a telemedicine infrastructure. In this, the existing base resources like users and technology was considered as a point of departure to extend the network. For example, users' interest towards the ambulance telemedicine technology

was used as the base for promoting the development, adoption, and use of telemedicine solutions to the ambulance services in other towns.

The approach of participatory design can also be argued to support the cultivation processes as it helps facilitate the users' learning of technology in the process of providing detailed information about their requirements and the ongoing work practices that surround it. Participatory design can also be seen as mechanism to help reduce users' resistance which is a major aspect of the installed base that influences the building of a large II (Markus, 2002). In both developed and developing countries, various methods of participation have been used by researchers such as evolutionary prototyping, workshops, meetings, formal and informal discussions and training (Byrne, 2004). Unlike the waterfall or construction approach, evolutionary prototyping approach is used to reshape the system as it is being developed by involving the users to give feedback on the earlier versions of the system (Wiryana, 1998). Based on case studies from South Africa, Mozambique and India, Puri *et al* (2004) have identified four methods of user participation to learn about the system development context in developing countries. These are; using methods based on existing traditions and customs; using mediating agencies; using existing hierarchies to create a space for local participation; and, by developing the capacity of the users. In developing countries, where there is high illiteracy rate, guiding users to understand their own requests has been described by Braa and Hedberg (2002) to be a useful approach to cultivate HIS. They have applied this approach in their work in South Africa.

In the above section, we have elaborated upon the importance of the II perspective as it has been drawn upon in IS research. Building on this broader perspective, II helps to emphasize the complexity of system development due to the inertia of the installed base and suggests a small incremental change process (cultivation) rather than trying to change it radically (a construction approach). As IIs are complex, the cultivation approach can also be seen to comprise of many strategies including gateways, modularization, user participation, and bootstrapping. In the next section, we argue that HIS are better

conceptualized and understood as HIIs, following which we outline our theoretical approach.

## 2.4 Conceptualizing HIS as HII

In the previous section, we identified the following features of II: heterogeneous, socio-technical network, open, enabling, shared, and evolving. In this section, we argue how HIS display these infrastructural features, and are thus better understood as HII.

HIS, by its very nature is extremely complex and interconnected consisting of heterogeneous socio-technical elements such as; different health programs and departments (TB, malaria, HIV AIDS, Plan and Program Department etc), health workers (physicians, nurses etc), levels of administration (district, province, national etc), papers, work procedures, computers etc. Information is reported or disseminated within various levels of the administration (vertically), among the health program and departments (horizontally) and to other sectors nationally or internationally, for different purposes. Accordingly, the HIS is not a private resource, rather it is shared by different sectors of the health department, public sector, and international agencies. HIS is open in the sense that new ISs with new group of users may emerge (for example, new health intervention area such as HIV/AIDS) as time passes by. These ISs should be integrated to the already existing HIS in order to enable the actors in the network to use the information for a variety of purposes (decision-making, action, planning, reporting etc). All these features help us to argue that HIS can be effectively conceptualized using concepts of II. We thus conceptualize HIS as a HII.

Having argued in the above section that HIS are better understood as HII, we now draw upon two concepts from the II theory, namely installed base and cultivation, which we argue provide very useful analytical insights into the challenges of scaling and standardizing. Conceptualizing HIS as HII implies that HIS develops and grows over a long time with layers upon and within one another. New features tend to get added as

extensions of or improvement to something already existing, the installed base, through the use of standards. As HIS is compartmentalized into sub-ISs both vertically (level of administration and horizontally (health programs and departments), there is a need to have standards to serve as a communication gateway. Standardizing in the health domain is generally considered to be the "silver bullet" to the problems of data exchange among collaborative partners vertically and horizontally. The rationale behind using standards in the health sector is therefore; if every one adopts the concepts, vocabulary and language, any data expressed with in this language will be accessible for every one else.

While researchers have agreed to the importance of 'universal standards' which can be used by the heterogeneous actors, they have also emphasized the need for flexibility of change (see for example, Hanseth, Monterio and Hatling, 1996) to address the local needs. For example, Braa and Hedberg (2002) have explained the different informational needs of the health hierarchies in South Africa. As a result, they introduced a modular approach of standardizing, which they named 'hierarchy of standards' which helped them to work towards a consensus amongst various actors during the standardizing process. Figure 2-1 illustrates the 'hierarchy of standards' using the South African health care structure. In the figure, the lower levels are indicated to have the right to define their own data set as long as they include the data set of the higher level. The core elements identified in the middle are those which are "inflexible" and need to be reported on to fulfill the needs of the national and international levels.

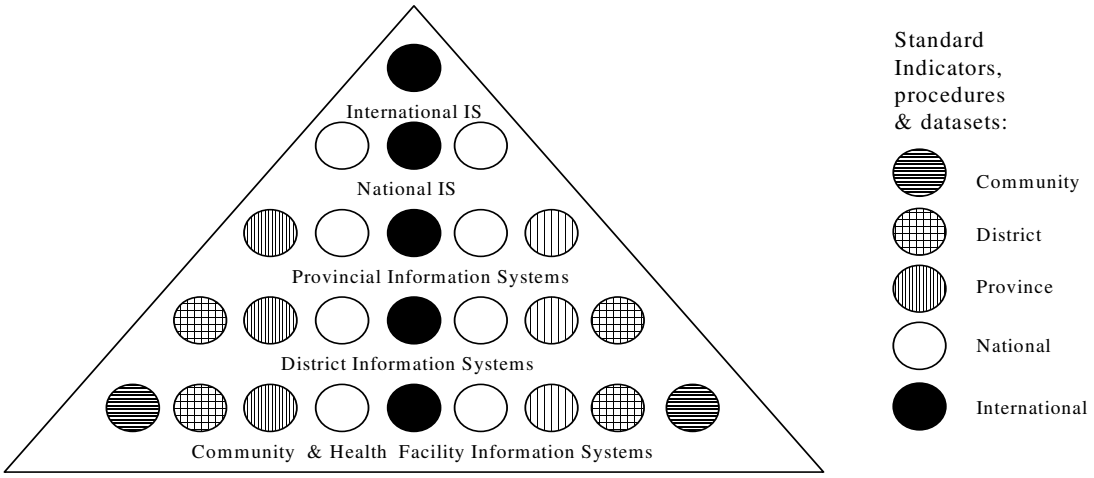



**Figure 2-1 Hierarchy of standards**

Standardizing in the context of health includes standards in relation to; data sets, data collecting and processing instruments, work practices and hardware and software systems. The II perspective informs us that this process of standardizing can not be started from scratch, rather it improves upon the already existing datasets, data collection instruments, work procedures, computer systems, physical infrastructures and that these processes will be shaped by the installed base. For example, the health data standardizing process in South Africa was highly influenced and shaped by the installed base of poor culture of information use and fragmentation of the reporting format which was the result of the earlier apartheid regime (Braa and Hedberg, 2000)

A HII has to scale functionally to incorporate new requirements of users over time and in scope to incorporate more users so that the provision of full coverage of health data will be possible. However, the installed base influences the scaling process. For example, Sahay and Walsham (2005) have indicated that the installed base of data items and reporting formats to influence the scaling of the DHIS in the health sector of one state in India. This scaling process was also restricted by various other contextual conditions such as infrastructure and political instability.

Therefore, there is a need to adopt a cultivation approach which respects the presence of the installed base during the process of scaling and standardizing a HII. As discussed above, cultivation is a process of small incremental changes over the installed base. This approach was used by Braa and Hedberg (2002) to develop a Minimum Essential Data set and the DHIS in South Africa. As we have discussed above, the cultivation of Minimum Essential Data was achieved through the principle of 'hierarchy of standards' and using an incremental approach which involved many cyclical phases to incorporate users' requirements. Furthermore, in order to develop a standardized computerized data base, they used an evolutionary prototyping approach.

## 2.5 Proposed theoretical perspective

In this section, we articulate the following three key principles underlining our theoretical perspective based on the above discussions.

1. We conceptualize HIS as HII, constituted of heterogeneous socio-technical networks such as; different health programs and departments, health workers, levels of administration, papers, work procedures, computers etc. The HII needs to be a shared resource amongst the users who are sharing the information, through different mechanisms (e.g. monthly, quarterly and annual reporting).

2. HII have to wrestle with the inertia of the installed base comprising of data sets, reporting formats, health programs, computer and physical infrastructures, which are deeply embedded in the political, social and cultural context. This installed base challenges the processes of scaling and standardizing, which needs to be based on extensions and improvements to what already, exists rather than starting from scratch.

3. The cultivation approach provides an approach to deal with the challenges of the installed base. This approach acknowledges the presence and influence of the installed base, and suggests piecemeal and incremental change process. There are

different approaches to apply the cultivation strategy; such as the use of gateways, modularization principles, and user participation.

These three principles thus will help us to theoretically conceptualize the HII, identify the challenges of scaling and standardizing, and also provide guidance on how to address these challenges. These are the objectives of the thesis as articulated in chapter one. In summary, in the analysis and discussion chapter (7), we will use the concepts of installed base and cultivation as analytical tools for our empirical material. The concept of installed base will be used to understand the challenges we faced during the scaling and standardizing process, while the concept of cultivation will be used to analyze and describe how to address these challenges.

In the next chapter, we present the research methods and design that we followed to conduct the research.

# 3 RESEARCH METHODS

## 3.1 Introduction

The study has two overall interrelated research objectives: *1) to understand the nature of the challenges of scaling and standardizing in the context of HIS in developing countries more broadly, and in Ethiopia in particular, and, based on this understanding, 2) to explore the particular approaches and strategies used to address these challenges, specifically within the context of the health sector in Ethiopia.* These research objectives have been met through firstly, carrying out a situation analysis of the HIS in the two regions, and secondly, by carrying out various action research interventions to implement the systems in the same regions.

This chapter is organized as follows. In section 3.2, we first provide some details about HISP Ethiopia more generally, and more specifically about the research team comprising of the two authors of this thesis who between them worked in the two regions. In section 3.3, we discuss the key elements of the research design which gives a description of our specific approaches to the case study and the action research. In section 3.4, we elaborate upon each of the data collection methods we used. Section 3.5 presents the modes of data analysis and interpretation, while section 3.6 discusses the ethical considerations we made to conduct the research. In section 3.7, we present the limitations of the study.

## 3.2 HISP Ethiopia and the research team

The specific research reported in this thesis was conducted in a team comprising of the two authors of this thesis and a PhD candidate. As we described in the introduction chapter (1), both the authors of this thesis started the research in July 2003 when we joined and also contributed to the establishment of the HISP Ethiopia entity. As members of this entity, along with the other members, we conducted in 2003 the first preliminary assessment of the HIS in the five regions of Ethiopia (Addis Ababa, Oromia, SNNPR,

Tigray and Benishangul Gumuz).

In the first semester of our study in Oslo, as we were writing our masters thesis proposal, our supervisors suggested the idea of a joint thesis, where the two of us could write it in a pair. The joint writing was a different concept for us and we found it both interesting and challenging. It was interesting from the point of view that it would gave us an opportunity to share ideas, expand the scope of our empirical focus, and support each other in the writing processes. Working in a pair, we would be able to access empirical material from two different case sites which would enable us to view the scaling and standardizing challenges of the same HIS, and how contextual variations across and also within regions shape these challenges. However, expanding the empirical base also magnified our action research involvement, and thus also simultaneously reduces the time we have for reflection and writing. But broadly we felt that the action research efforts would be made stronger by working in a team, and it also related to the very nature of action research effort itself where the researcher is expected to introduce change for the problems identified. After evaluating the pros and cons of writing in a pair, and taking into account the views of our supervisors, we decided to write the thesis in a pair.

Empirically, we decided to divide the case into two regions; with one of us being responsible for Addis Ababa and the other one for Oromia. We also got the opportunity to initiate HISP in a third region, Amhara, which helped us to draw upon some of these experiences in our analysis (see chapter 7). However, we decided not to report the Amhara experience as a full blown case study as our field work there was not as extensive as in the other two regions, and we also felt it would make the thesis more unwieldy. Also, since both of us are resident in Addis, it was easier to do a full blown study in Addis and Oromia, and a similar effort could into Amhara which was much more expensive and difficult to access.

The differences between the context of Oromia and Addis Ababa; in terms of

geographical size, population levels, infrastructure, staff commitment etc. led to differences in the research approaches applied by the two of us. While in Addis Ababa, more time was used to the standardizing process, system design and training of users, etc. in Oromia, more time was used for initial studies and pilot testing. At some points during our fieldwork, the differences in context of study and conditions made us feel we were doing two different research projects. However, as we became more aware of both the differences and similarities, and our research focus on the scaling and standardizing challenges became sharper, we could get a better understanding of the complementarities between the cases. This inter case comparison, we understood, could both contribute to the overall research objective; understanding the challenges related to scaling and standardizing in the context of HIS in developing countries; and, based on this understanding, to investigate and implement possible approaches to address the challenges within an action research framework.

## 3.3 Research design

Our research design can be described to be constituted by two key features: comparative case study and an action research framework approach. These are now discussed.

- **Comparative case study**

The study was conducted in the two case study sites from which an analysis of scaling and standardizing was conducted which further contributed to draw some generalizations and conclusions. Case study is an important approach to study situated phenomenon and typically involves the use of qualitative research methods. A case study helps the researcher to explore in depth a program, an event, an activity, a process, or the social actions of one or more individuals. The case(s) are bounded by time and activity, and researchers collect detailed information about the particular phenomenon in focus over a sustained period of time (Stake, 1995). Benbasat, Goldstein and Mead, (2002) describe a case study as follows:

> A case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or few entities (People, groups, or organizations) (Benbasat, Goldstein and Mead, 2002, p. 81)

A case study can be particularly significant to study 'in practice-based problems, where the experiences of the actors are important and the context of action is critical' (Benbasat, Goldstein and Mead, 2002, p.80). Central to a case research design is the decision to include single or comparative cases for the analysis. Yin (1984) suggests the use of single-case studies where the cases are revelatory, critical or unique, while a comparative case study design is a powerful way of studying the same phenomenon in different settings, and to analyze how different contextual conditions shape the phenomenon, For example, Barley (1986) studied the implementation of the same technology (CT Scanners) in two hospitals in USA, and this comparative design allowed him to make inferences as to why the same technology had different outcomes. To generate theories applicable to various organizational contexts and to distinguish different change processes, Orlikowski (2002) situated her empirical study under a comparative case study research design framework in two organizational experiences with the use of CASE tools. She argued for the use of comparative case study design as an important way to analyze social phenomenon in situated settings. In general, comparative case research design is acknowledged by researchers to be helpful for cross-case analysis and to develop more general research findings (Benbasat, Goldstein and Mead, 2002). Taking the advantage of working in a pair, and also to help strengthen the action research interventions, we positioned our research in comparative case study research design.

In our study, in line with our research objectives, the phenomenon under analysis related to the processes of scaling and standardizing around the same HIS and in the same country context. By observing these similar processes in different settings, we were able to make inferences on what contextual conditions shape these processes and how. More specifically, our comparative case study design involved the regions of Oromia and Addis Ababa regions of Ethiopia. In both sites, HISP processes, including the design of data

sets, introduction of DHIS software, and training were ongoing, although in different degrees and rhythms.

The case study sites were selected as per our interests when HISP-Ethiopia was being initiated and organized in July 2003. Addis Ababa was chosen for its significance as the capital city of the country, and also because of the logistical ease of research access since we live in the city. Also, in addition, Addis was the first region where the HISP implementation was initiated. Next, we selected the region of Oromia because of its large size (scaling issues become particularly pertinent), its proximity to Addis, and also the relative ease of access because of this proximity. There were interesting differences in context with Addis Ababa, the capital, being comparatively rich with well developed infrastructure; while Oromia is a vast region and with very poor infrastructure. This difference in the case study sites, as we describe in the analysis chapter (7), contributed to very different outcomes with respect to scaling and standardizing. While in Addis Ababa, the HISP action research proceeded relatively quickly to reach full geographical coverage through the implementation of the new database application in all ten sub-cities of the city, in Oromia the outcomes were different. Here for various reasons, much more work went into preparing the ground for the action research as compared to Addis, and the implementation of the database application could only include a tiny fraction of the geographical area; one out of the fourteen administrative zones. The following table summarizes the administrative levels that were covered in the research in each regional setting.

| Regions | RHB | Zonal office | Sub-city/wereda | Health facilities |
|---|---|---|---|---|
| Addis Ababa | AAGRHB | NA | All 10 sub-cites | Five hospitals<br>Three health centers<br>2 health posts |
| Oromia | ORHB | Eastern shoa zone | Four weredas, two rural and two urban | Two hospitals<br>Two health centers<br>One health post<br>One clinic |

**Table 3-1 Research coverage**

- **Action Research framework**

This research reported falls under the framework of action research design as we used it for studying and improving the HIS in our case study sites broadly, and to the study of challenges of scaling and standardizing specifically.

Action research as a research approach originated in socio-psychological studies of social and work life issues, and has been argued to be well suited to the study of technology in its context (Baskerville and Wood-Harper, 2002). This is due to the fact that actions taken to introduce technology can be largely affected by the organizational context and that the action researchers can identify and devise a strategy to its more effective adoption and use. Action research is "learning by doing" in which a group of people, including researchers and the client organization, work together to solve commonly experienced problems. Action research is often uniquely identified by its dual goal of both improving the organization and at the same time generating new knowledge – both theoretical and practical. Accomplishing these goals requires the active collaboration of the researcher

and client, and thus it stresses the importance of co-learning as a primary aspect of the research process (Baskerville and Wood-Harper, 2002). An action research design should lead to the development of a stronger linkage between organizations and research centers, and contribute to organizational development and improvement (Kock *et al*, 1997).

The researchers' perception of the client organization may vary over time, as their knowledge of the organization increases, gathered through formal interaction and also informal conversations and communication between the researchers and the client staff. Such interaction also helps to generate more general knowledge that is crucial to solve the problem at hand, and also in adding to the scientific knowledge in particular research domains. In order to create opportunities for the sharing of the scientific knowledge, experience, technology and value, Braa, Monteiro and Sahay (2003) have emphasized the pivotal importance of "networks in action" as an effective form of action research, especially relevant in developing country settings. Basing their empirical study on the different nodes of the HISP network countries (for example, South Africa, Mozambique, Tanzania, India, etc), they argued that action research interventions needs to be conceptualized and approached as one element in a larger network of action in order to meet the grave challenges of making localized action sustainable and scaleable. Their focus was on how actions such as related to software development, training approaches and experiences are effectively shared across the different nodes of the network in an environment of mutual learning.

The major difference between action research and other research methods is its focus on the real world to solve practical processes by engaging in cyclical processes of problem definition and taking, and reflecting on action to address these problems. Baskerville and Wood-Harper (2002) describe these cyclical processes in the following five identifiable phases: 1) diagnosing; 2) action planning; 3) action taking; 4) evaluation; and, 5) specifying learning. The phases fundamentally require the establishment of the client-system infrastructure or research environment, which helps to outline the specification and formal and informal agreements. Similarly, our action research process can also be

described to correspond to these cyclical phases, initiated through informal agreements between the RHBs and the HISP team. We now discuss each phase as corresponding to the HISP action research intervention in Addis Ababa and Oromia as depicted in 3-1below.

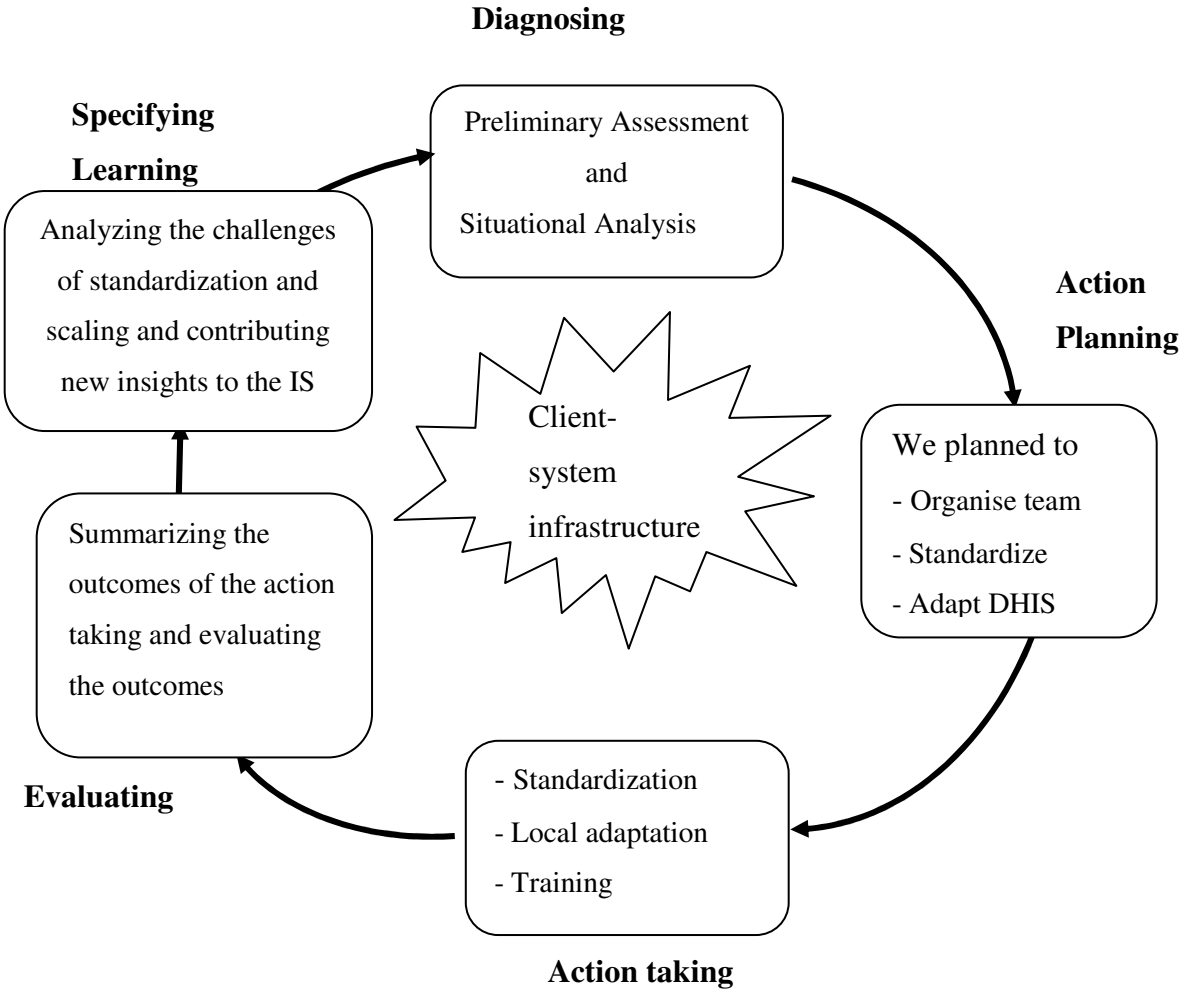



**Figure 3-1 The action research cycle as applied to our study**

**(Source: Baskerville and Wood-Harper, 2002)**

**Diagnosing:** in this phase we identified the primary problems which should be changed in order to improve the existing HIS through a preliminary assessment and situation analysis in the two regions. Therefore, we were able to identify the major problems to be

related to scaling and standardizing, such as cumbersome data sets, inconsistent work procedures, and poor infrastructure. The data for this phase were collected through qualitative data collection techniques; interviews, observation, questionnaire and document analysis (which we discuss in the next section of this chapter). The time frame for this phase ranges from June 2003 to January 2004.We present the findings of the diagnosis phase in the situation analysis chapter (5)

**Action planning**: Together with the staff of the client organization (RHBs), we planned to start the work first by initiating the process of standardizing the data set to relieve or improve the problems identified in the diagnosing phase. We also planned to adapt the DHIS software that was transferred from South Africa to the local context of Ethiopia. We based our plan on the requirements and differences identified during the previous phase. The system implementation were planned to be carried out in all the SHDs of Addis with out choosing a specific pilot site, and in Oromia a decision was made to start in one pilot zone; Eastern Shoa.

**Action taking:** We moved to the actual improvement activities in this phase. The work of standardizing the data set, data collecting formats and procedures were carried out in this phase through active participation of health workers at all levels (facility, sub-city/wereda, zone and region). The DHIS software was initially adapted to incorporate mainly the Morbidity and Mortality (MM) module. Evolutionary prototyping was used as the system development methodology to introduce the system to the organization gradually and to help the system be adapted to the inevitable changes taking place through this process (Avison and Fitzeberg, 2003; Wiryana 1998, Sommerville, 2001). An important action research intervention was the provision of training on how to use the system, and also on concepts related to standardizing. Training was provided both through workshops and individualized attention in particular health facilities through the visit of the researchers and the support staff. After the software was implemented in the SHDs in Addis and the weredas of Eastern Shoa Zone in Oromia, attempts were initiated to scale the system to the health facilities (in Addis) and other zones (in Oromia). The

detailed discussions on the actions taken to improve the existing HIS, and evaluations and reflections on the outcomes achieved, is provided in the action research intervention chapter (6).

**Evaluating:** After all the actions that we have explained in the previous phase were completed, we listed down the outcomes to know whether the action we took had brought about useful changes or not. We then planned what should be done in the next iteration of the action research cycle, which is described in the 'outcomes of the action taking' and 'evaluation of the outcomes' at the end of the action research intervention chapter (6).

**Specifying learning**: In this phase, we analyzed the challenges that we had experienced in scaling and standardizing the HII, and its fundamental role in improving the overall IS. Accordingly, we argue to have contributed to both theoretical and practical knowledge to the IS community more broadly, and more specifically to the domain of health information in developing countries. The in depth analysis of the case studies drawing upon concepts from the II theory is presented in the analysis chapter (7).

## 3.4 Data collection methods

Qualitative methods were used for collecting data; in all the phases of the action research. Qualitative research methods have been developed in the social sciences to enable researchers to study people, and the social and cultural context with in which they live (Myers and Avison, 2002). We applied this method as it was compatible with our purpose of investigating the challenges of scaling and standardizing the same HIS in different contexts.

To get reliable and rich data, multiple qualitative data collection methods (interviews, observations, questionnaires, and document analysis) were used. We now discuss each of the data collection methods briefly below:

- **Interviews**

Interviewing is one of the most common and most powerful ways to understand human being since it gives room to both the interviewer and interviewee to clarify opinions and points of view through interactions (Creswell, 2003). We used semi-structured interviews to collect data from the health facility, wereda/sub-city, zonal, regional and national levels We interviewed staff who were responsible for collecting, processing, reporting as well as relaying monthly health reports up and down the health service structure. We also interviewed people who work for international Non Governmental Organizations (NGOs) to understand their influence on the HII improvement Table 3-2 summarizes the number of interviewees conducted in each region.

We used various approaches in each region to identify and interview the informants. For instance, in Addis due to its compactness, we went to their work place to conduct interviews, where as in Oromia, we used the action interventions periods such as during training workshops and while conducting installation and supervision to interview the concerned persons at the zonal and wereda levels. This approach also reflected the scaling challenges that we studied on our own research process, as it helped us to save time and transportation costs. We did not use tape recorders as the informants were not very comfortable with that. We made hand written notes during the interviews which were later typed up in greater detail.

| Data collection Methods | | | No of respondents/visited place | |
|---|---|---|---|---|
| | | | **Addis Ababa** | **Oromia** |
| Interview | HF | Hospital | 5 | 5 |
| | | Health center | 24 | 4 |
| | | Health post | 2 | 2 |
| | Wereda/sub-city | | 10 | 4 |
| | Zone | | *NA | 1 |
| | Region | | 5 | 8 |
| | National | | The HIS team leader was interviewed | |
| | NGO | | Two staff of Essential Health Service for Ethiopia (ESHE[3]) were interviewed | |

***NA=Not Applicable**

**Table 3-2 Number of interviewees**

The interview questions and discussion agendas were different according to the informants' position. For example, health workers who were engaged in data collection and processing activities, were asked about how they collect, process, report and use data. Where as we asked health managers questions related to how they have been tried to address their current perceived informational problems, and their plans for the future. Furthermore, we frequently discussed with the regional HMIS team both formally and informally to both facilitate the action research and cross check the information that we got from other informants.

[3] A non government organization in Ethiopia

- **Observations**

Observations are used in the field sites by taking field notes on the behavior and activities of individuals in the research site (Creswell, 2003). Participant observation was employed in the field sites we visited during the implementation of DHIS, and also during training workshops. Furthermore, we also made direct observation in the various health facilities to understand the various information flows, the existing infrastructure, the social relationships between the staff, and the kinds of artifacts that were being used in the HII. We also observed the work practices and reporting systems when we went to the field sites for various activities such as system installation and supervision.

As participant observers, we participated in workshops that were organized for health workers at different levels to discuss the quarterly and annual performance. The workshops helped us to understand the social, managerial, and organizational problems, which contributed to the poor and inefficient systems. For example, in the workshops, the statisticians expressed concerns with their multiple responsibilities which they argued contributed to their late reporting.

A series of meetings were also held with the Plan and Program Department and other regional staff throughout the implementation process so as to facilitate the implementation of DHIS, and to find solutions to the obstacles encountered. For example, the absence of computers and poor human resource capacity were identified as major constraints to the functioning of the HII. In such meetings, we participated as representatives of HISP, and also as researchers which had implications on the need to systematically record and document our field notes and impressions.

- **Questionnaires**

Questionnaires can be used to involve many respondents to get their views on particular predefined issues. Questionnaires are useful to help get information from a large number of people within a limited time (Creswell, 2003). Therefore, we used questionnaire (see

Appendix B) with health workers at the wereda and health facility levels to get the general picture of the operational information flows, the surrounding practices, and the infrastructure. However, we used this approach only in the pilot site of Oromia and not in Addis where it was used as an interview guide rather than distributing and collecting it later from the respondents. We preferred this approach, taking the advantage of Addis's small size, to help modify the questionnaire based on the answers of respondents. The questionnaire was divided into three sections namely ISs, Information Technology (IT) related, and evaluation of DHIS training. In Oromia, the questionnaires were distributed to 18 HMIS personnel. The results of the questionnaire mainly helped us to make an inventory of the available computer-based resources and also issues of timeliness and completeness of data.

- **Document analysis**

Document analysis involves making sense out of text and image data. It helps to get useful information related to the researcher's interest, and supplement other forms of data collected (Creswell, 2003). We analyzed different documents related to our studies including data collection formats and health data at various levels. We also studied the recent strategic plans, policies and publications in relation to our research area to understand the situation in general and challenges for scaling and standardizing the HII specifically. The document analysis was done through out the course of the study (August 2003- August 2005). The following table summarizes the type of documents which we reviewed and its relevance to our study.

| Types of document | Relevance to the study |
|---|---|
| Strategic plans of RHBs, publications of the MOH and the National health policy. | To learn the intention and visions of the RHBs and the MOH to establish computer based HIS. It also helped us to identify the plans and the actual HIS in practice. |
| ICT policy and some ICT related publications. | To understand the long term government plan to apply ICT in the health sector and its potential implication on scaling strategies. |
| Monthly and quarterly reports of the health department. | To understand the type and number of data elements collected routinely, and to infer the needs for standardizing the data set and the data collecting formats. Also, to help evaluate the data quality and the work practices around the data collection and processing activities. |
| DHIS training manual of South Africa- | To prepare the user manual based on the context of the DHIS users in Addis Ababa and Oromia. |
| Literature on HIS specifically and IS in general. | To understand the research domain; HIS and to position our research findings on the ongoing debates in IS and HIS research. |

**Table 3-3 Documents reviewed during the research**

- **Photographs**

We captured different photographs while we were out for field work and action research interventions to complement our interviews and other data. The photographs include; data collection tools, infrastructure, the filling systems, different training sessions, and standardizing workshops. We believe that these photographs help to enrich our description of the context, as a "picture speaks more than a thousand words." We also photographed the informants' written feedback to provide more authenticity to our interpretations.

## 3.5 Modes of data analysis and interpretation

We discussed amongst the two of us and the other members of HISP our meanings of the raw data obtained from interviews and questionnaires in order to develop the narratives of our case studies. From the broad narrative description of the case study, we selected issues which we interpreted to be related to scaling and standardizing. With respect to scaling we identified the following challenges: a) lack of national level involvement, b) poor culture of information use, c)inadequate public health inputs in the HISP team, d) time and logistics constraints, e) large geographic size; and f) contextual differences in the health systems. With respect to standardizing, we identified the following challenges: a) uneven infrastructural development; b) the presence of Legacy IS, c) varying management commitment, d) Large geographic size, and, e) Differences in organizational and functional requirements.

In identifying these challenges we used the interpretations of interview and questionnaire data, and also our experiences from carrying out the action research interventions. For example, the following quotation was interpreted to reflect a scaling related challenge:

> *When there is a need to go to the WerHO for different purposes including reporting, I have to wait up until market day to get transportation. Sometimes, I use the vehicle of the wererda Agriculture Office if by chance they come here to visit their work sites (Health worker at health post, December 2004).*

The health worker who stated the above quotation was explaining how she communicates to the different weredas in Oromia region. Such an inference was also further supported with the use of photograph which depicted the poor state of roads. Both of these pieces of "evidence" led to the interpretation of the challenge of transportation which had implications on the scaling (and also standardizing) process.

Similarly, the following example was reflective of the standardizing challenge:

> *More items should be added. For example, ESR, WBC, D/F, Blood group, Hemoglobin should be included in the laboratory reporting format. It is not enough to summaries all these as 'others'. These are helpful for me to request reagents (Laboratory Technician, November, 2004)*

Another example which reflected the standardizing challenge was:

> *Standardizing is not as such a simple work that we can do together with a small group of people. It needs more time We also need to coordinate the zones and organize a workshop that requires time, budget and human resource. The department is understaffed… as you know the team leader submitted a letter asking for release and the current staff are new. Any way, we will be focusing more on standardizing in the next three month (Department head, ORHB, December 2004).*

The first quote reflects the weak culture of information, and the practice of health staff wanting to collect more data with the aim to make visible to their superiors that "they were working" rather than with the objective of supporting local level action. Such a work practice was counterproductive to the efforts of standardizing which had the aim of reducing the data elements based on the principle of "information for local action". The second quote emphasizes the amount of work, negotiations, time and logistical arrangements that need to be done to enable the standardizing process. These arrangements were often difficult to do because of various reasons such as the heavy workload of staff, transportation limitations, and the insufficient management commitment.

Our analysis can thus be described as an inductive process although we had certain concepts at hand that were drawn from II theory, to help make sense of the particular challenges to scaling and standardizing. We first analyzed each case separately, that helped us to identify particular challenges to scaling and standardizing. Subsequently, we considered inter-case comparisons and tried to relate the similarities and differences of these challenges to aspects of the social-political and institutional contexts. Finally, we related these differences to the theoretical concepts of installed base and cultivation to

make more general inferences drawn from our research. These inferences related to the inter relationships between scaling and standardizing and the inherent dilemmas.

## 3.6 Ethical considerations

The following ethical considerations were maintained during our study.

1. We submitted a letter that required cooperation for access to information for study purposes. The cooperation letter was obtained from the University of Oslo, Informatics department. This letter mainly helped us to get access to information in RHBs, NGOs and MOH.
2. The RHBs also gave us a cooperation letter to get access to information with in the respective weredas, zones, and health facilities.
3. All informants that participated in the study were promised confidentiality, and their participation was voluntary.

## 3.7 Study limitations

The success and failure of the implementation process depends on the interaction of many events and factors, some of which are in the control of the researchers and others not. For example, in Oromia, a long period of time was taken to have a minimum data set to design the final database. The RHBs failed to finalize a minimum data set in the specified time due to various administrative and organizational factors, such as the staff having a heavy work load and many meetings to attend. The sheer size of the region and the need for the officials to travel from one spot to another also limited their availability and participation in the standardizing process. Moreover, since there was no assigned budget for the ongoing HIS activity, it slowed down the action research interventions in this region, such as providing technical support or training. Sometimes, accelerating the implementation process required bypassing the chain of command and going straight to the top managers at the RHBs.

Furthermore, most of the produced documents, except the monthly reports in Oromia region were prepared in their local language Oromifa, which required translation to be used for the study purpose. Moreover, due to the time limitation we were not able to visit more health facilities that would have enabled us to develop a better understanding and generalization about our problem area.

In this chapter, we have presented the research approach, the design and data collection methods and analysis process for identifying and addressing the challenges of scaling and standardizing HIS in developing countries more generally, and in the two regions of Ethiopia in particular. The action research cycle presented in this chapter gives the guiding framework to describe the situation analysis (chapter 5) and this is followed by the action research interventions (chapter 6) and the analysis and discussion chapter (7). In the next chapter, we will present the situation analysis at the federal level and in the two RHBs.

# 4 RESEARCH CONTEXT

## 4.1 Introduction

In this chapter, a description of the research context more broadly (Ethiopia) and more specifically of the two regions that are the case study sites (Addis Ababa and Oromia) is provided. Each of the descriptions (nation and regions) includes details of the administrative and political structures, geography and socio-demographic status. In addition, we provide details of the HISP context including its initiation and current status in Ethiopia.

Accordingly, the chapter is organized in the following manner. In section 4.2, we present the context of Ethiopia, and sections 4.3 and 4.4 describe the contexts of Addis Ababa and Oromia regions respectively. Section 4.5 provides a comparative analysis of the two regions. And in the last section (4.6), we elaborate the context of HISP global and Ethiopia.

## 4.2 Ethiopia: summary of country profile

Ethiopia is one of the least developed countries in the African region, and also one of the continent's oldest independent countries. The country is located in the horn of Africa and is best known in the Western media for its periodic drought, famine, and protracted civil war. Covering an area of approximately 1.3 million square kilometers, Ethiopia is a land locked country bordered by Sudan on the West, Somali and Djibouti on the East, Eritrea on the North and Kenya on the South. The following map shows the administrative regions of Ethiopia and its neighboring countries.

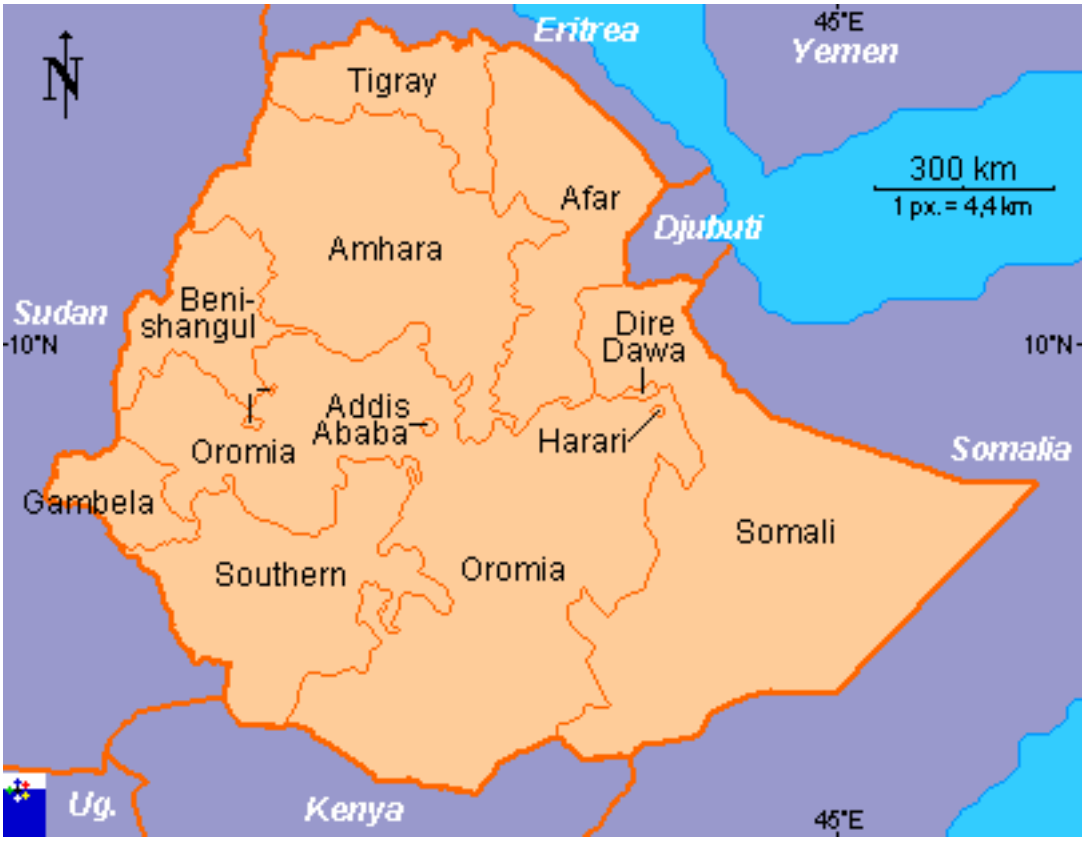



**Figure 4-1Administrative and political structure**

- **Administrative and political structure**

Ethiopia is divided into 9 ethnically-based regional states; Amhara, Benishangule-Gumuz, Gambella, Harari people, Oromia, Somali, Tigray and SNNPR and two administrative cities; Addis Ababa and Dire Dawa as depicted in the figure above.

At its outset, the Ethiopian constitution grants the regional states the status of a nation, and they are given rights of self-determination up to secession. The regional states have their respective autonomous governments set up under proclamation No. 7/1992. Each regional government includes a State Council (the highest organ of state authority) and a

State Administration (highest organ of executive power). The State Council plans, approves, leads and controls economic and social development programmes. The State Administration is the highest executive authority of the regional government and is elected by the State Council and includes 15 Executive Committee members. The ethnic groups are represented in the House of Federation whose members are elected by the state councils.

- **Socio-demographic status**

The country's economy is highly dependent on agriculture through which 85 % of the populations earn their livelihoods. The agriculture sector respectively accounts for half of the GDP and 60% of the exports nationally. Coffee, hide, and skin are key agricultural products, but remain vulnerable to drought and poor cultivation practices. High donor dependency is an outcome of the country's attempts to address this vulnerability.

According to population estimates for July 1998-2004 (derived by projecting the 1994 census), the total population of Ethiopia is 69.1 million (CSA, 1994), in which children under 15 years of age contribute to 44% of the total population. The average annual population growth rate is 2.7%, and a population density of 52.2 persons per square km. The population that is provided with safe drinking water is only 24% as compared to the world average of 81%. This is even lower than that of other low-income countries such as Mozambique (60%) and Rwanda (41%) (MOH Ethiopia, 2004)

In the country as a whole, there are more than eighty languages spoken. Among those, Amharic, Oromiffa, Tigrinya and Somali are spoken by the majority of the population. Official government documents are available both in Amharic and English. In the health sector, most of the reporting formats and written documents are available in their English version.

Ethiopia uses the Julian calendar which is divided into 12 months of 30 days each and a 13th month of five or six days at the end of the year. The Ethiopian calendar is seven years and eight months behind than that of the Gregorian calendar. Furthermore, the country is three hours ahead of Greenwich Mean Time. Time remains constant throughout the year in Ethiopia. The Ethiopian day is calculated in a manner similar to that in many equatorial countries, where day and night are always the same length: counting starts at Western 6:00 a.m. and 6:00 p.m. Western 7:00 a.m. is, therefore, one o'clock, noon is six, 6:00 p.m. is twelve o'clock, and so on. This different dating system has implications in the customization of international software, for example for health care, to the local context.

- **The Ethiopian health care system**

According to the recent health policy of the government of Ethiopia, emphasis is given to improve access of all segments of the population to a basic package of quality primary health care services, via a decentralized state system of governance. To this end, the first Health Sector Development Programme (HSDP I) introduced, in 2000, a four tier system for health service delivery. This is characterized by Primary Health Care (PHC) units, comprising of one health center and five satellite health posts, and then the district hospital, zonal hospital and specialized referral hospital. A PHC unit has been planned to serve 25,000 people, while a district and a zonal hospital are each expected to serve 250,000 and 1,000,000 people respectively (MOH Ethiopia, 2002). Consequently, the decentralization process gives the primary responsibility of managing the PHC services to the wereda (sub-city in Addis). However, in practice it is often seen that there are hardly any health centers having five health posts under it, and available health posts are often unable to provide the required services due to lack of medical facilities and staff. To strengthen the health sector development plan, the MOH has recently published a five year (2005-2009) plan of expanding the PHC care coverage through constructing and equipping of 563 new health centers and upgrading 2167 existing health stations to health centers.

The health status of the people, in terms of preventable infectious diseases, nutritional deficiency, infant and maternal mortality is very high. All types of malaria, Bronchopneumonia, and acute upper respiratory infections are amongst the top leading illnesses in the country. According to the 2003/2004 national health indicators, the infant mortality rate in the country is 96.8 per 1000 live births while the maternal mortality rate accounts for 87.1 per 1000 live births. As compared to the WHO standard of 1:10,000 (ratio of physician to people served), the Ethiopian average is 1:25958 indicating the significant overburdening of physicians. There is also inter-regional variation in the distribution of physicians. For example, in Somali a physician serves 72,764 people and in Addis Ababa 13, 164. Table 4-1 shows the health status of Ethiopia as compared to other neighboring countries with a broadly similar economic status. As the table shows, Ethiopia is the most populous country in this group, and has the third highest Infant Mortality Rate (IMR) amongst the eastern African countries. Ethiopia is next to Somalia in Crude Birth Rate (CBR) and equal to Eritrea in Crude Death Rate (CDR).

| East African Countries | Population (Millions) | CBR | CDR | IMR |
|---|---|---|---|---|
| Ethiopia | 69.1 | 40 | 13 | 97 |
| Djibouti | 0.7 | 39 | 19 | 117 |
| Somalia | 8 | 48 | 19 | 126 |
| Kenya | 31.6 | 35 | 15 | 66 |
| Eritrea | 4.4 | 41 | 13 | 48 |

**Table 4-1 The health status of Ethiopia as compared to neighboring countries**

**(Source: Health and health related indicators 1995 (2002/03 GC), MOH)**

- **The Status of ICT in Ethiopia**

Computers were introduced into Ethiopia in the early 1960's by some organizations like Ethiopian Airlines, Economic Commission for Africa (ECA), Ethio-Djibouti Railway Company, Imperial Board of Telecommunications, and the Haile Selasie I University. The Ethiopian Science and Technology Commission and Ethiopian Telecommunications Corporation has contributed significantly to introduce ICTs and create public awareness in the country.

Initially, the National Computer Committee, and then the National Computer Centre, that were hosted in the Ethiopian Science and Technology Commission, played a leading role in enabling the imports of IT products by providing evaluation reports in relation to the context of the country. In addition to that, the National Computer and Information Centre (NCIC) played a leading role to develop the national ICT policy which describes the development of a national ICT infrastructure as one of the national strategic components to make changes and improve the determinants of national socio-economic performance.

As of July 2003, the Ethiopian Information Communication Technology Development Authority (EICTDA) was established by Proclamation No. 360/2003 with the objective of utilizing ICT for socio-economic development and the building of democracy and good governance in the country (Federal Negarit Gazeta, 2003). The authority designed various projects to develop the ICT infrastructure at the three tiers of the government system (Federal, Region and Wereda). Out of these, the Wereda-Net and the Content and Application Development Projects are the major ones. The Wereda net project is aimed to develop ICT infrastructure in 571 weredas of the country (EICTDA, December 2004). The Content and Application Project is also working in identifying the prioritised sector organizations' (Health, Agriculture and Education) content to develop shareable applications and to utilize the established infrastructure. The MOH is a member of a steering committee in EICTDA to utilize the established Wereda-Net infrastructure for the health sector. Currently, the MOH has identified four content areas; HIS, human

resources, integrated financial management, and property management to develop applications that will be a shared resource amongst the health institutions at various levels.

Currently, computers are being used in the health sector mostly for word processing activities. To make the best use of ICT, there are some efforts and initiatives which are ongoing to implement telemedicine in collaboration with different governmental and international agencies since 2002.

After providing a brief summary of the socio-economic and health profile, and the infrastructure status at the national level, some further details are provided of the Addis Ababa and Oromia regions where the case studies reported in this thesis were conducted.

## 4.3 Addis Ababa region

Addis Ababa has been serving as the capital city of Ethiopia since the Menelik regime, in 1890. Recently, the Ethiopian constitution article 49 has declared Addis Ababa to be the capital city of the Federal state. The city is the seat of large organizations and government offices including the Federal Government. The office of the MOH is also found in the city. Addis Ababa is host to the offices of the African Union and United Nations Economic Commission for Africa (UNECA).

- **Administrative and political structure**

The structure of the organs of power of the city include; the city government, 10 sub-cities and 100 Kebeles. The governance is administered through the city council, mayor, city cabinet, city judicial organs and the office of the chief auditor of the city council. At the level of the sub-city, there is the sub-city council, sub-city chief executive, and sub-city standing committee. And for the kebeles, there is the Kebeles council, Kebele chief executive, Kebele standing committee, and Kebele social court. The city is divided into

10 sub-city administrations that is equal to a district or Wereda (in Ethiopia) each comprising of 250,000-300,000 people. The sub-city administrations are: Arada, Lideta, Kolfe-keranio, Kirkos, Gulele, Nifas Silk, Yeka, Akaki-kality, Addis Ketema and Bole.

- **Geography and socio-demographic profile**

According to the population estimate of July 1998-2004, the total population of the city is 2, 805, 000 with a 1.5% growth rate (CSA, 1994). The city covers 540 square kilometers, and its altitude ranges from 2,000 to 2,500 meters above sea level, and is dominated by the 3,000 meters high Entoto Mountains immediately to the north. The city is located at the center of the country, around which lie all the country's other administrative districts. Thus, geographically, Addis stands at the very heart of Ethiopia. The grain producing areas lie to the north, north-west and east of the city, and while the coffee growing areas lie to the west and south. The capital enjoys excellent infrastructural connections with all Ethiopia's economic zones. Manufacturing plants for steel fabrication, wood, tanneries, textiles, cement, leather goods and breweries are among the activities located in and around Addis Ababa, making it the center of commerce and industry for Ethiopia.

As the largest city of Ethiopia and economic center of the country, Addis Ababa is by far well developed in terms of modern technology (e.g. internet, mobile phone), roads and other facilities as compared to other regions. Also, socially, there is a representation of the different ethnic groups in the capital. As it has been mentioned earlier, nationally, there are more than eighty languages and dialects and as many cultural variations. Each of the ethnic groups is represented somewhere in the capital. In addition, the large numbers of foreign residents, from all parts of the world, contribute to the city's vibrant cosmopolitan atmosphere.

- **Health service status**

Addis Ababa City Government Health Bureau (AACGHB) is responsible for the provision of both curative and preventive health care activities of the city. According to the Ethiopian national health indicators, there are 22 hospitals in the city of which 5 are owned by the RHB and 5 by the Federal level. There are also 28 health centers and 46 health posts in the region. AACGHB administers one public health laboratory and 1 nursing school. Health facilities found in Addis Ababa are located with in a 540 square kms area where as the health facilities in Oromia are dispersed over an area of 359,619.8 square km. These differences in compactness and vastness of the regions, as will be subsequently described in the case study and analysis chapters, influenced the scaling process of the systems in our study.

There are also 456 clinics of which 6 are run by the city administration, 28 by NGOs and 56 by other government organizations, 46 by factories and 320 by private owners. In addition to these, there are about 180 retail drug outlets and 46 health posts (30 run by the sub-city administration and 16 by NGOs). Moreover, the city has about 40 NGOs working in Addis Ababa on different health activities by signing legal tripartite agreements with the health bureau, the Social, and NGOs affairs offices of the city administration. As indicated by national health indicators, a better health facility and health worker distribution is seen in this region as compared to the other regions of the country.

## 4.4 Oromia region

Oromia is one of the biggest and the most populated region in Ethiopia. The geographical area is about 359,619.8 sq km, which is about 30% of the country's total land mass. It shares internal borders with all regions of Ethiopia except Tigray. It also shares international borders with Sudan in the south west and Kenya in the south. According to the population projection of Central Statistical Authority (CSA) 1994,

Oromia is now home to an estimated 24, 394, 556 people with a 1:1 sex ratio. The average population density of the region is 67 people per square km and varies from 137 people per square km in the East Shoa zone to the sparsely populated zones of Boerne, 16 people per square km.(ORHB, 2003). Population densities are highest in the highland areas and lowest in the low land areas of the region. Health service coverage and utilization of existing health facilities are also highly affected by the geographical distribution and the settlement of population. More health facilities are situated in urban areas to serve mostly the urban population. On the contrary, there are limited numbers of health facilities in the rural areas. This poor geographical distribution of clinics together with the lack of culture to go to hospital to get medication in the rural areas, has made the rural population to depend heavily on traditional medicines as compared to the modern systems offered by the governmental systems.

- **Administrative and political structure**

There are three government organs in the region that makes, enforces, and interprets law called "Caffee", "Regional executive body" and "regional Judiciary body" respectively. The region has 14 zones and 2 special zones consisting of 198 administrative weredas of which 15 of them are town weredas. There are 6,500 peasant associations and 564 kebeles, the smallest administrative units in rural and urban areas respectively, administered by the respective weredas. Health service is being administered by local managers of the health facility, controlled and supervised by the respective wereda health office, zonal health desks, RHB and the MOH hierarchically

- **Socio-economic profile**

The region has diverse ethnic groups, religion, culture and agro-climatic conditions. Oromia is also known for its long-standing traditional democratic system (the Geda). Agriculture is the backbone of the region making for the livelihood for 89% of its population and accounting for about 65% of the GDP in the region. Coffee, hide and skin

and pulses are the major export commodities. According to the 1994 census, 85% of the people living in Oromia region are ethnically Oromos. "Afan Oromo" is the mother tongue for Oromo people, and has been the working language of the region since 1996. Before that Amharic was used as the working language like in other regions of the country.

- **Health infrastructure**

Most of hospitals and health centers are located at the urban areas while the health posts and health stations are in rural areas. The number of health facilities owned by different bodies is presented in Table 4-2

| Health Facility Type | RHB | NGO | OGO | Total |
|---|---|---|---|---|
| Hospital | 21 | 4 | 4 | 29 |
| Health Center | 135 | 2 | 2 | 139 |
| Health Station | 768 | 80 | 103 | 951 |
| Health Post | 332 | 7 | - | 339 |

**Table 4-2 Available health facilities in Oromia region**

**(Source: ORHB strategic planning management document (SPM) 1996 -1998 (July 2004- July 2006)**

As shown in the above table, most of the health facilities (75%) are owned by the RHB while the rest are managed by NGOs and Other-Governmental Organizations (OGO). The region has also six health practice teaching schools. Two of them give a two-year diploma program in health sciences while the remaining four provide a one-year certificate program for health professionals. Both of them have an annual intake capacity each for about 500 students.

## 4.5 Comparison of the context of the two regions

The following table provides a comparative overview of the two regional settings in terms of geographical size, number of weredas/sub-cities, population size, etc. Drawing from the discussions of the two regional contexts, the health infrastructure in Addis Ababa is seen to be well developed to serve the population, though not adequate as compared to its population size. In Oromia, people need to travel long distances either on foot or in a traditional way to get access to primary health care services. Table 4-3 compares some of the significant parameters that have the potential to influence the scaling and standardizing processes in the two regions. We will discuss the influence of these parameters in the analysis and discussion chapter (7).

| Parameter | Addis Ababa | Oromia |
|---|---|---|
| Geographical size | 540km$^2$ | 359,619.8 km$^2$ |
| No. of weredas/ Sub-cities | 10 | 198 |
| Population size | 2, 805, 000 | 24, 394, 556 |
| Population growth rate | 1.5% | 2.9% |
| Physicians population ratio | 1:13,164 | 1:60,835 |
| No. of hospitals | 5 | 21 |
| No. health centers | 24 | 135 |
| No. of health posts | 46 | 332 |
| Working Language | Amharic | Oromifa |

**Table 4-3 Comparison of the two regional settings**

## 4.6 The Health Information System Program context

HISP is a collaborative research and development program comprising the University of Oslo, the University of Cape Town, University of Eduardo Mondlane, and Institute of Health Management in Norway, South Africa, Mozambique and India respectively. HISP was established in South Africa after the fall of apartheid and the advent of democracy in 1994 (Braa and Hedberg, 2002), and is currently still ongoing.

HISP originated with the aim of using data that are generated during the delivery of health delivery service, for action and planning at the level where the data are generated. The primary goal of this program is to enhance the information use behavior of health planners and workers in the health sector of developing countries by strengthening local professional capacity for the development of sustainable HIS (Braa *et al*. 2003). With this aim, the program has developed a database application called DHIS software to support the then emerging decentralized administrative structures in three pilot districts in Cape Town, South Africa. The DHIS was subsequently accepted by the National Department of Health in the pilot districts in early 1999 (Braa and Hedberg, 2002) and is now a national standard for routine data analysis and reporting in South Africa.

In 2000, the HISP project was established in Mozambique, a neighboring country to South Africa. The software was translated to Portuguese and adapted to the Mozambican context (Kaasbøll and Nhampossa, 2002, Braa, Monteiro and Sahay 2003). The Eduardo Mondlane University of Maputo and the Mozambican MOH have become collaborative members of a growing HISP network. The software has later been adopted by Malawi and Tanzania, and pilot projects have been initiated in India, Tanzania, Vietnam and Ethiopia.

- **DHIS software: system overview**

DHIS software is Microsoft Access based with a Visual Basic interface. It also uses Microsoft Excel spreadsheet to manipulate pivot tables for data analysis. It is open-source in the sense that the client can get the software with its source code and is free to customize and redistribute. The software offers flexibility to all levels to make additional local standards as, for example, new data elements, indicators and validation rules to the set of standards that is inherited from the parent unit in the reporting hierarchy. This local flexibility is an important strength of the DHIS that makes it well suitable for supporting a district-approach to PHC in developing countries more generally.

The DHIS software has three main modules; the Monthly Data (MD) module, the TB module and the Report Generator (RG) module. Monthly and Semi-permanent data entry, verification and analysis are performed in the MD module. The following figure shows the interface of the DHIS software MD module.

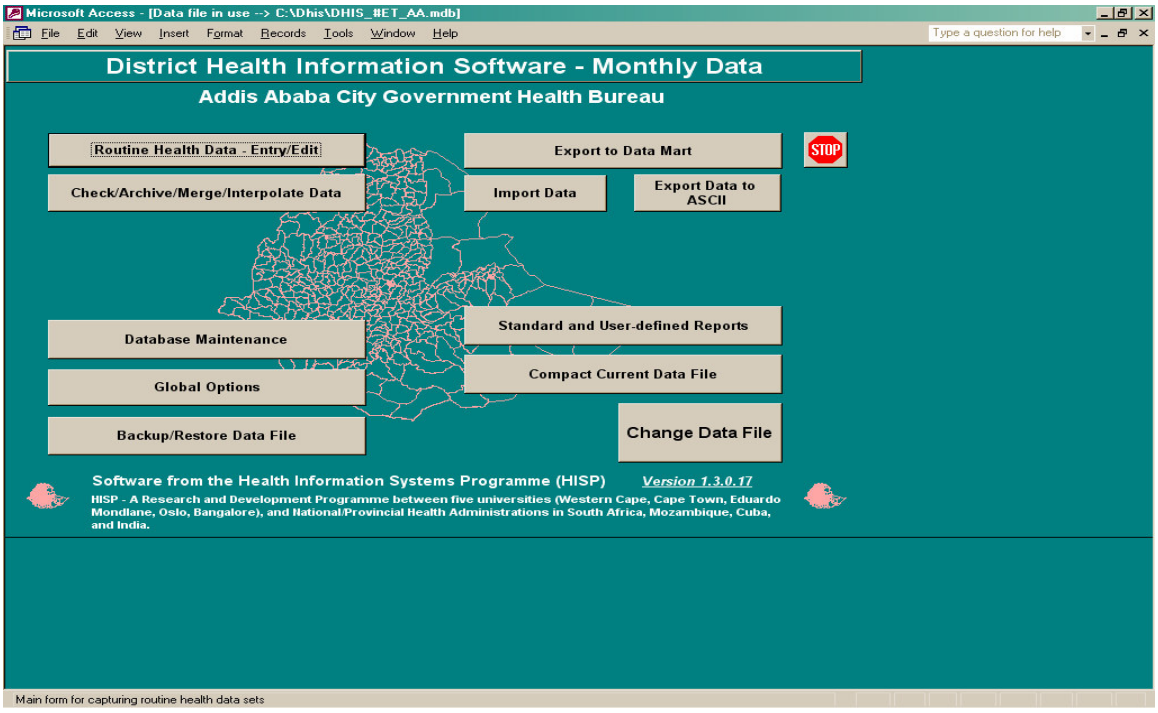



**Figure 4-2 Front page of the DHIS software**

The TB module is used for TB and Leprosy data entry, verification and analysis. As the name indicates, the RG module is used to generate reports from the data base. These are the front ends of the software. Data are stored in the backend (such as DHIS_#oo and DHIS_xoo). DHIS_#oo contains the basic Access data files which are the organizational units (facilities), data elements and the data. To enable data manipulation in the pivot tables and to view standard reports (which looks like the paper-reporting format), the export functionality of the system creates a temporary data mart file called DHIS_xoo from which the pivot tables (DHIS_$oo) are generated. Therefore, when data entry is made, the data will automatically be stored in DHIS_#00. The stored data can be exported to text file to make the reports. At the same time, the stored data can be sent to Data Mart to generate standard reports or to make data manipulation and analysis. The following figure summarizes the health data flow in DHIS.

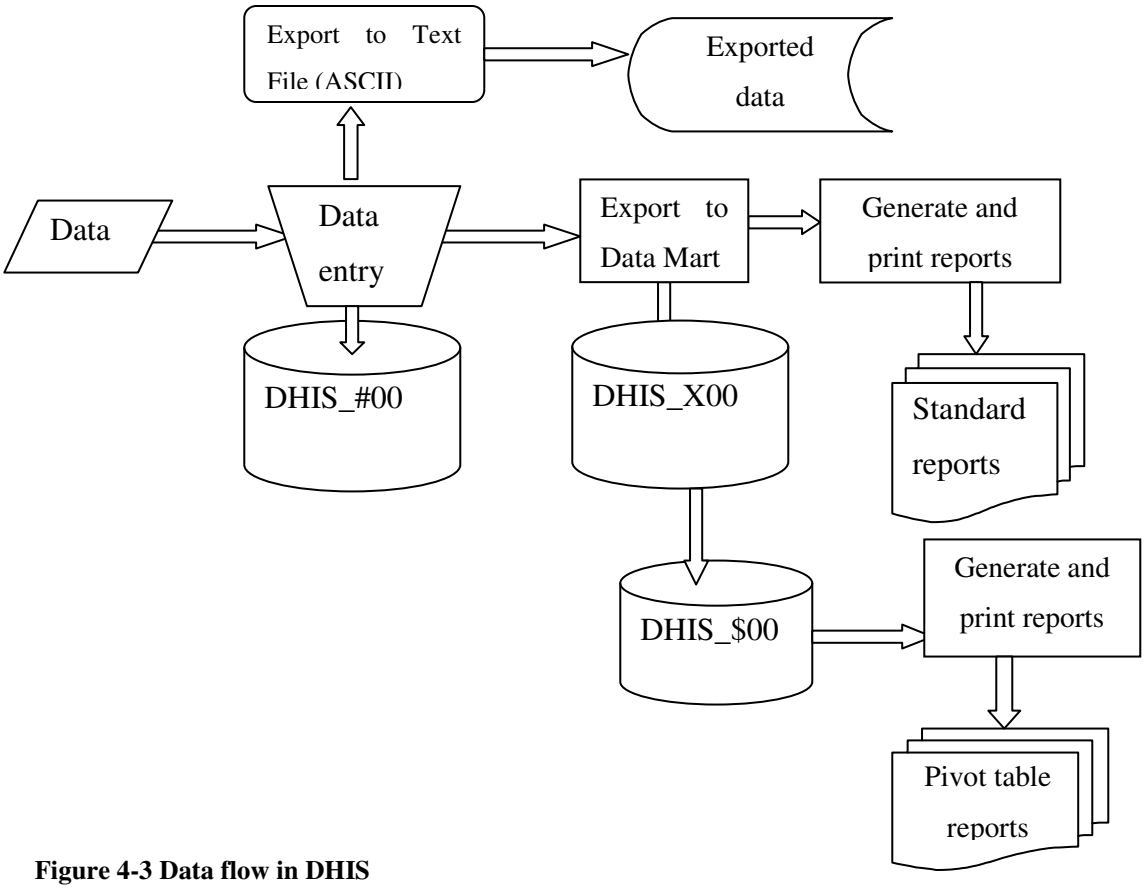



**Figure 4-3 Data flow in DHIS**

In South Africa, the software was developed with the following objectives (Braa and Hedberg, 2002 p.14):

- Shift of control of ISs from central towards local levels, i.e. towards more equal control between central and local levels.
- Local flexibility and user orientation – it should be easy to adapt the software to local conditions.
- Support for health sector reform towards decentralization and the development of health districts, i.e. integrating the vertical flows at district level.
- Support empowerment of local management, health workers and communities.
- Horizontal flow of information and knowledge, based on the principle of free access to all anonymous, aggregated health data/information.

Both the ability to use and analyze data disaggregated locally and the possibility to make local elements, indicators and procedures are important features of the software. The software is multilingual, using a separate multilingual module for fast translation to any language. Currently the software is available in Portuguese, Spanish, Telegu (India), etc. This software is being implemented in the regions of Ethiopia with the collaboration of the global and local HISP networks. In the following section we will discuss the initiation and status of HISP in Ethiopia more broadly.

### ▪ The status of HISP in Ethiopia

In February, 2003, the need for introducing a computer based HIS in the Ethiopian health care sector was initiated by a Norwegian professor through creating a link with Addis Ababa University and recruiting PhD and Masters students. Currently, the HISP-Ethiopia team comprises of four doctoral and five (including us) Masters Students of Informatics and Public Health in the University of Oslo, Norway and Eduardo Mondlane University, Mozambique respectively. The students are supervised by faculty members from Norway and Mozambique. These students have made preliminary situation analyses in five

regions (Addis Ababa, Oromia, Tigray, Benishangule-Gumuz, and Southern Nations, Nationalities and People) in 2003. The findings of the preliminary assessment have shown that the existing paper-based system was not efficient and effective to support the management activities to support the provision of PHC services to the population.

The need for urgently restructuring the current HIS was inferred from the preliminary situation analysis. This need for restructuring also has been emphasized by various national reports, and also international agencies like the UNDP. Accordingly, the work of conducting depth study of the current system, including issues of standardizing the monthly reporting format and customizing the DHIS software, was started with the RHBs; first in Addis Ababa region. This work led to the development of a standardized data set and a customized DHIS-Ethiopia application, both of which became the point of departure to initiate work in other HISP pilot regions like Oromia which has been also reported in this thesis.

At this time, the program is hosted in the Faculty of Informatics, Addis Ababa University as a unit of the research and teaching process. Nearly fifteen of the Informatics faculty at the Addis Ababa University are directly or indirectly part of the HISP efforts. A Memorandum of Understanding (MOU) has been signed between the department and the University of Oslo with the aim to improve the existing HIS through building the local capacity and introducing a computerized HIS. In addition to strengthening the implementation process, the MOU seeks to support education and research activities of the department, including Masters and Doctoral level education.

HISP Ethiopia has started the work of improving the current HIS at the regional level aiming to scale the system across and within regions down to zone, wereda and health facility and up to the national levels. Currently HISP has been working with four regional states (Oromia, Amhara, Tigray and Benishangule-Gumuz) and one city government (Addis Ababa). The following figure shows the HISP-Ethiopia pilot regions in general and our research sites specifically

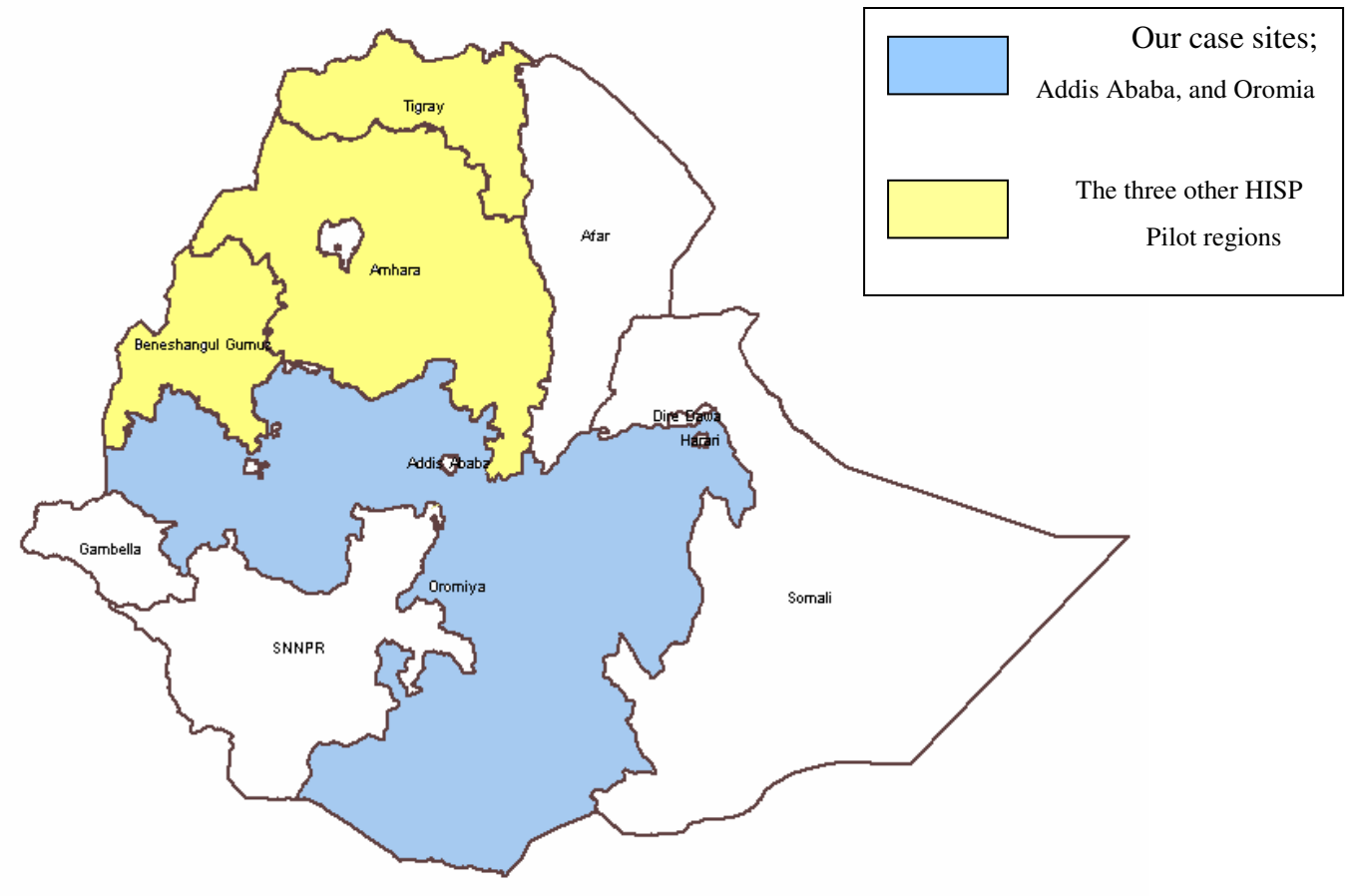



**Figure 4-4 HISP pilot regions in Ethiopia**

In this chapter, we have presented the context of the research and the HISP action research initiative which provides the umbrella for this reported research. While the research reported in this thesis was conducted in two regions (Addis Ababa and Oromia), HISP Ethiopia is ongoing in five regions. In the next chapter, the case studies are described.

# 5 CASE STUDIES: SITUATION ANALYSIS

## 5.1 Introduction

In this chapter, we present the situation analysis of the existing HII in Addis and Oromia regions of Ethiopia. The situation analysis reported in this chapter represents the first phase of the action research cycle described in the research methods chapter (3). Following the situation analysis, in the next chapter, we will discuss the action research interventions carried out in each of the research settings, and the outcomes that were observed and our reflections and evaluations of the interventions.

The chapter is organized in three sections. The first section discusses the existing HII situation at national level and the remaining two sections present the situation analysis of the HII in Addis Ababa and Oromia regions respectively. Under each case, the information handling processes (data collection, processing, analysis, and reporting) of the existing system are described. The infrastructures and related resources at each level of the health administrations are also assessed as they have a direct influence on the functioning of the HII. The data for the analysis were gathered through structured and semi-structured interviews, observations, informal discussions and document analyses.

## 5.2 The current HII situation at the national level

The MOH, head quartered in Addis Ababa, is organized under six departments, and has the overall responsibility in formulating and implementing health policies and regulations in the country. In terms of the HII, this level is organized vertically under four departments: Disease Prevention and Control, Family Health, Hygiene and Environmental Health, and Plan and Program (See Appendix D1). Each department consists of a team of people responsible for a specific health program. Each health program typically has a separate set of data collection instruments which are managed by the respective health program expert/staff. The Health Information Processing and

Documentation Team (HIPDT), which is found under the Plan and Program Department, is primarily responsible for the collection of MM data, while other reports are the responsibility of the respective departments. The health structure can be described as being primarily vertical, implying the manner in which reports and commands are flowing. The head of the HIPDT explained the vertical structure of the HII as follows:

> *Since we can not satisfy the information needs of other departments at the Ministry, they have started getting reports directly from the program experts /departments of the RHBs. Recently, with lots of efforts, I have started getting a copy of each report which is coming to the Ministry (HIPDT leader, MOH, November, 2004).*

At the federal level, reports are received from the 11 RHBs, Federal hospitals, Police hospitals and Defence hospitals annually, biannually and on a quarterly basis. Based on these reports, the team produces and disseminates two major publications to the concerned bodies. The HIPDT explained how they disseminate the publications and the problems related to it as follows:

> *The team publishes a yearly indicator and performance implementation report based on the quarter department and annual RHB reports. About 2,500 copies of the yearly indicators are published and disseminated to RHBs, departments, governmental bodies, NGOs, donors, and embassies. However, it is impossible to get reports from all regions on time. Therefore, we sometimes, are forced to produce the publications by omitting the region that we did not receive reports (HIPDT leader, MOH, November, 2004)*

In the absence of a comprehensive computerised system, the received data are processed and analysed using MS Excel, EpiInfo, and SPSS. The shortage of staff in the HIPDT was reported to be a major impediment to improve the national HII, described as being inefficient and ineffective by many respondents in reports and interviews. A respondent emphasized the human resource related problems as follows:

> *The team is supposed to have seven employees; however, currently, we are three with Masters, Bsc., and Diploma level. Vacancies were announced to fill in the staff requirement, but no one has showed up to apply due to the low government employee's salary as compared to the market. Recently, we have enquired the administration to re-structure the team to upgrade the salary and positions to get the required professional (HIPDT leader, MOH, November, 2004).*

With the limited staff they have, the HIPDT is responsible to maintain the standard data collection and reporting formats, and to coordinate with the RHBs to improve the national HII for supporting the delivery of the PHC services to the community. However, the team does not currently seem capable enough to handle this responsibility effectively because of other additional and competing tasks. For example, a member described the additional tasks he is required to perform by being involved in a number of committee assignments.

> *I am involved in a number of committees like ICT, curriculum design, HAPCO (HIV/AIDS prevention and control office), HIS and so on. You can see here all these files are related with the committee which makes me very busy (HIPDT leader, MOH, November 2004).*

The data collection and reporting formats have never been updated, to date, after its first distribution 20 years ago. Accordingly, they have lost their uniformity across regions and down to the health hierarchies. As a result, currently, efforts are being exerted by the federal level and also international agencies to launch a comprehensive national computerised HII to improve the data processing, analysis and transmission processes. This is intended to be preceded by standardising the data set and data collecting and processing instruments. Accordingly, the MOH has established an advisory committee and distributed the Terms of Reference calling international consultants to participate in HIS study nationally. Attempts are also ongoing to prepare a national strategic policy which is important for the setting of national Minimum Essential Data which the country currently lacks. The HIPDT leader explained these current reform efforts at the national level as follows:

> *Currently, an advisory committee is established to improve the existing health management information system by developing a strategy to define data collection, reporting formats and standard indicators, and to identify the requirements of the new system at all levels. The Drug Administration Control Authority, the Ethiopian Health and Nutrition Research Institute and three regional health bureaus (SNNPR, Oromia and Amhara) are members of the advisory committee. It is supervised by my boss (the Planning department head) and I am also secretary of the committee. So far, the committee developed terms of reference to outsource the project (HIPDT team leader, MOH, November 2004).*

Some RHBs have taken individual initiatives, supported by donor agencies, to improve the HII in their own settings, in addition to and independent of the national efforts at reform. For example, the work of Essential Health for Ethiopia (ESHE) (a donor agency) in SNNPR region is among those to be mentioned. Another initiative is that of HISP, which we are involved with in some of the RHBs, such as Addis Ababa, Oromia and Amhara. Even if the RHBs have a strong wish to improve the system, they are challenged by the regional contextual conditions (such as finance, infrastructure, geographic size etc.). Here, it is to be noted that unlike the financial constraints that most regions have, at the national level, this is not such a big issue. Rather, the human resources and the institutional bureaucracy seem to be challenging to the improvement of the system. The following figure 5-1 shows the general information flow for regions that have five administrative levels (like Oromia).

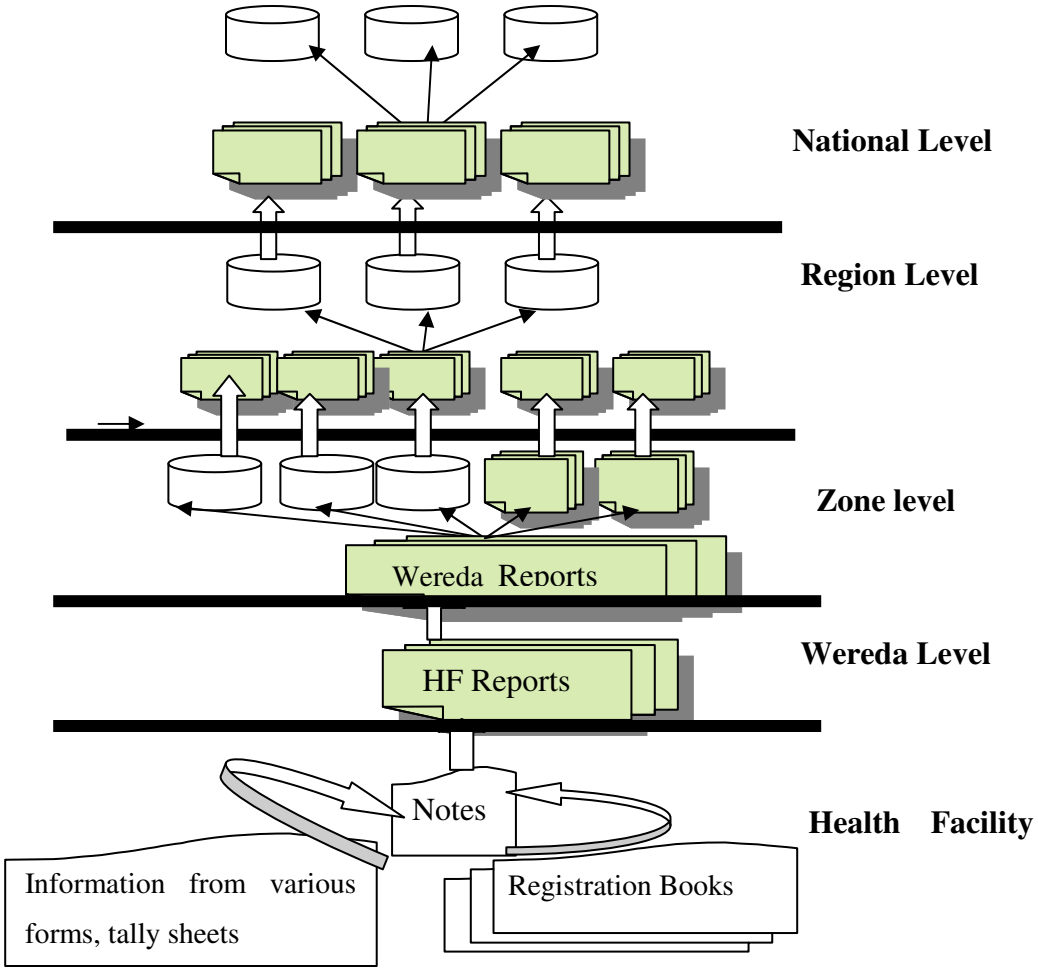



**Figure 5-1 Overview of the national health information flow**

Following this section, we discuss the situation analysis of the AACGHB which was carried out as the first phase (diagnosis) of the action research cycle.

## 5.3 Addis Ababa region

- **General overview**

AACGHB was established in 2001 as an independent institution. After this year, the direct control of the MOH was changed to only technical support. Currently, AACGHB is directly accountable to the Addis Ababa City Government Council, which is the highest governing body of the Regional City Government (See Appendix D2). The HII in Addis Ababa is organized under four levels; National, Regional, Sub-city and Facility, and the information flows structure corresponds to these levels. Similar to the relationship between the RHB and MOH, the SHD depends on the RHB, primarily for technical matters. The SHDs are accountable to the Sub-city Capacity Building Department. This dual accountability has implications on the timeliness and completeness of the HII, as the region does not have power to force the SHDs to submit reports on time. The general flow of health data with in the health administrative levels is represented in Figure 5-2. The figure illustrates the four levels of the health administration and the corresponding departments, and the persons responsible for the data collection, processing and reporting activities. We will discuss the detail under each level in the following sub-sections.

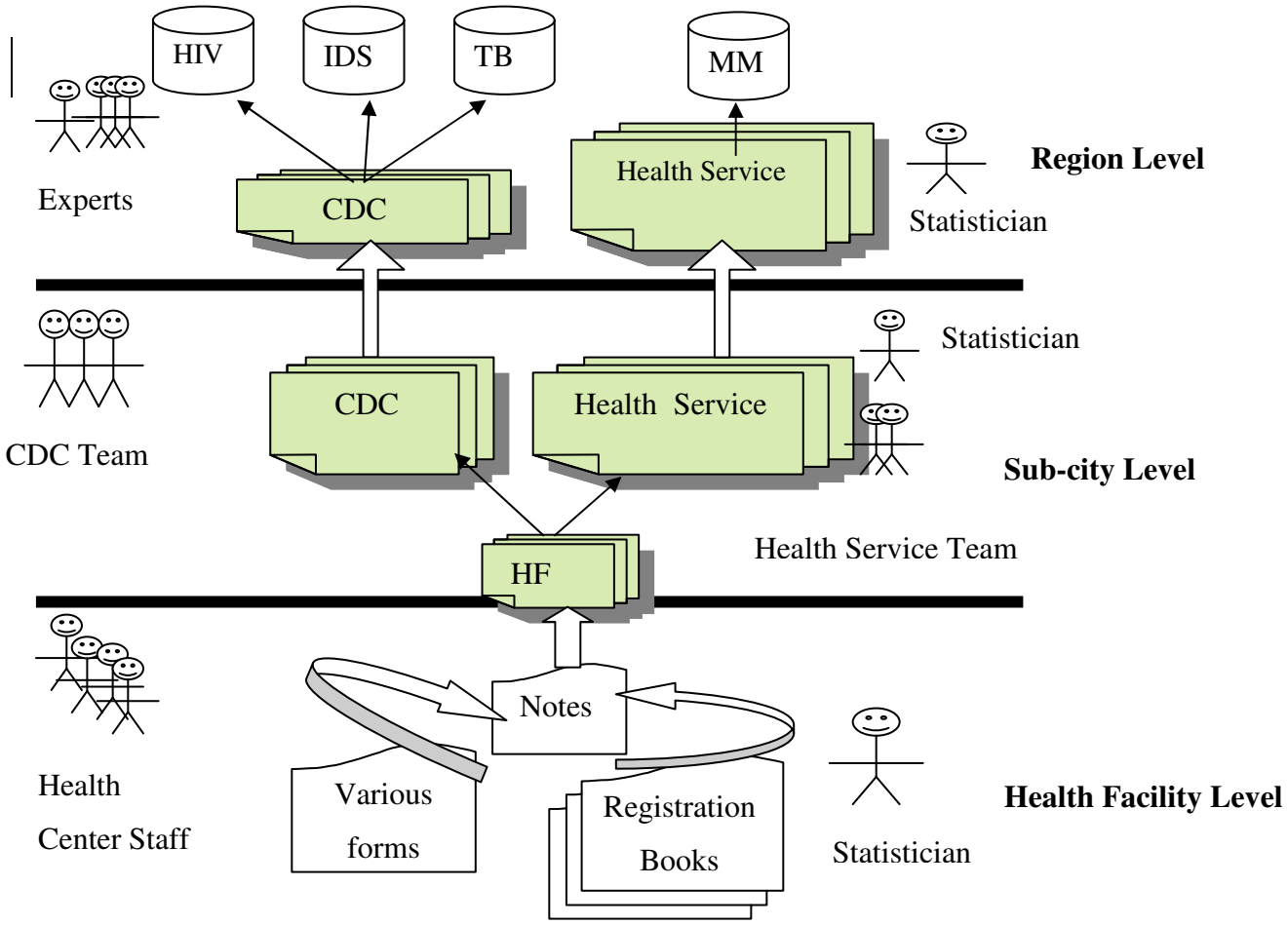



**Figure 5-2 Overview of the overall information flow in AACGHB**

- **Health facility level**

Health facilities are the starting point for the information flow. Data collection is the first stage in the information processing activity and is comprised of several processes and procedures, including for data generation, recording, and compilation activities at the health facility level. Routine data are generated at the health facility when a patient or a client comes to get a certain service. At this point, data of the client or patient are recorded. The recorded data on each such transaction are compiled at the end of the month to get the monthly reports.

At the health facility level, except the health posts where the service is limited, there exists a specific organizational structure for statisticians. The statisticians are responsible for the collection of the MM data from the outpatient and inpatient departments and the compilation of all other types (See Table 5-1) of data into the monthly reporting format. Despite the statistician position being in place, we found most of the staff occupying the post to have neither the statistical nor medical background required. From the eight statisticians we interviewed, only two had a diploma in statistics, one had completed twelve years of school and others had a background in Business and Economics4 . Regarding this issue of educational background of statisticians, the family health expert at the RHB said:

> *Most of the 'statisticians' are neither statisticians nor medical persons. Therefore, the probability of making errors while counting cases from the registers is high. For example, one time, I got extremely low number of antenatal visits from the hospitals and I made the nurses responsible for that work to count it again. I got significant differences. It is impossible to trust the quality of data knowing this kind of cases (Family Health expert, January 2004).*

With respect to training on information handling, there did not appear to be any specific existing program to train statisticians. Apparently, when new staff were assigned for this work, it was difficult for them to understand the work procedures and data sources, which influenced the quality of the data. For example, during this research a new member was transferred to the statistics office of one of the hospitals to substitute a statistician who resigned from the job. We found her collecting HIV/AIDS data from two registers which contained the same data but were used for different purposes. This doubled the number of HIV/AIDS patients who were reported to be seen in that specific hospital. However, no one told or gave her training on how and what to collect when she was assigned for the job. She explained this condition as follows:

[4] Business and Economics is used to refer to professional backgrounds like management, accounting, marketing etc

> *I did not know before this time that these two registers contain same data. When the person left the job, they asked me to work on his position and I agreed thinking that it is better than from what I am doing before. But, when I started the work, I found it very confusing. I do not have any one to ask to clear out my confusions. Therefore, I am learning by trial and error (Statistician at a hospital, November, 2005)*

All the statisticians we interviewed were not satisfied by the salary that they received as compared to the work they expected to perform. A statistician of a health centre said:

> *I have been doing this kind of statistical work for ten years but my salary is only 400 birr. No one considers me as useful….I like the job but I'm very much discouraged by the salary, if I can get another job I will not hesitate to leave this one (Statistician a health center, November, 2004)*

A statistician of a hospital also explained '….because of the salary I prefer to work in my profession, accounting' (Statistician at hospital, November, 2004).

The absence of training on information handling together with the tendency of the experienced ones to leave the job for better salary also had an impact on the data quality as the new statisticians would miss or double count data.

With regard to the data collection procedures, each department of the health facility was responsible to maintain records of all cases. Primary data collection tools like registration books, tally sheets, forms and patient or client cards, were used for maintaining records. These tools are sources of data to fill out the secondary data collection tools (monthly reporting formats) that are sent to the SHD. In all health centres, except MM data, all the data are compiled from the primary data collection tools to the monthly reporting formats by the health professionals, who are also involved in providing medical services. Unlike the statisticians, some of the health workers explained that they had received training on information handling. One of the health workers at the health facility said:

> *I am a focal person for [*Integrated Disease Surveillance Report] *(IDSR) and [Integrated Management of Childhood Illness] (IMCI) data collection and compilation activities. They gave me training on how to collect these data and*

> *what each data element means at the outset of the new reporting formats. Therefore, every month, I collect these data from the IMCI and morbidity tally sheet and submit to the statistician in addition to my permanent clinical activities (Nurse at health center, October, 2005)*

The collection of the daily MM tally sheet and the compilation activity on to the monthly reporting format are the responsibilities of the statistician. However, in the hospitals there was no standardized data collection procedure. For example, in some of the hospitals, the statisticians were responsible for collecting the raw data from registers of each department. In others, the health workers were responsible for the collection from the registers into the monthly reporting and to submit it to the statistician for reporting. They did not have a clear understanding about the boundaries of their responsibilities with regard to data collection. Therefore, there was always a struggle between the health workers and the statisticians on who should collect what data from which register books, which we believe contributed to the generation of poor quality data. In all cases, the MM data collection and compilation was seen as the primary responsibility of the statistician. This implied a focus of the overall health service on curative activities rather than preventive. However, developing countries, such as Ethiopia need a shift of focus on preventable diseases as most of the population are dying due to these diseases, which are largely preventable.

Table 5-1 illustrates the types and sources of routine data that the region needs to collect on a monthly and quarterly basis at the facility level. The types of data are organized by the departments that are responsible for the designing and distribution of the data collection instruments. The departments determine what should be collected for the specific health program and they are also one group of end-users of the collected data.

| TYPE OF ROUTINE DATA | PRIMARY DATA COLLECTION TOOL |
|---|---|
| **Family Health** | |
| Antenatal Visits | ▪ Referred during antenatal visit register<br>▪ Antenatal tally sheet<br>▪ Antenatal registration book |
| Delivery | Delivery registration book |
| Postnatal | Postnatal registration book |
| Post abortion | Post abortion registers |
| Expanded Program for Immunization(EPI) | ▪ Routine EPI activity registration book<br>▪ Tetanus Vaccination Registration Book<br>▪ Daily EPI tally sheets<br>▪ Monthly EPI tally sheets |
| Family planning | ▪ Family planning registers<br>▪ Family planning tally sheet<br>▪ Clients card |
| Integrated Management of Childhood Illness (IMCI) | IMCI Registration book |
| Integrated Disease Surveillance Report(IDSR) | ▪ IMCI registration book<br>▪ Daily outpatient MM sheet |
| Nutrition | IMCI registration book |
| Growth Monitoring | ▪ IMCI registration book<br>▪ EPI tally sheet |
| **Disease Prevention and Control** | |
| Tuberculosis (TB) and Leprosy | ▪ National Leprosy and TB Control Program Unit Leprosy registers<br>▪ National Leprosy and TB Control Program Unit TB registers |
| Sexually Transmitted Diseases | ▪ Medical outpatient MM logbook<br>▪ Outpatient Visit tally sheets |
| Voluntary Counselling and Testing(VCT) | VCT registers |
| HIV/AIDS | HIV/AIDS registers |
| **Health service** | |
| Morbidity Mortality (see the section on morbidity and mortality data for detail) | ▪ Daily outpatient tally sheet<br>▪ Admission registers(Patient card)<br>▪ Outpatient log books |
| Diagnostic tests | ▪ Laboratory registers<br>▪ X-ray registers<br>▪ Ultrasound registers<br>▪ Pathology registers |

**Table 5-1 Primary sources of data that are colleted on monthly and quarterly basis**

As Table 5-1 shows, some types of data such as IDSR do not have a specific data collection instrument. Health workers gather these data from registration books or tally sheets that are prepared for other purposes, and are seen to consume much of their time. Some times, there is a need for compiling the monthly data from different sources as one source is not enough to get the required data. Most often, the tally sheets are designed by the health workers to facilitate their data collection and compilation activities. This implies a lack of consideration to design primary data collecting instruments that can feed the monthly and quarterly reporting formats. The discrepancy and unavailability of primary data collecting instruments is an indication of the poorly functioning HII.

The type of data that should be collected differs with the availability of manpower and medical facilities such as the laboratory. Accordingly, health posts collect data on antenatal care, family planning and health education activities. Health centres collect data on family health, disease prevention and control, and outpatient MM statistics. In the hospitals, all types of data that are listed in the Table 5.1 are collected.

**Morbidity and Mortality data: collection procedures and quality**

The MM data are generated through the consultation of patients. When these data are recorded, diagnoses are expected to be represented by the ICD code (International Classification of Diseases) in addition to the name of the diseases. ICD codes are a standard diagnostic code of diseases that was published by WHO first in 1948.

In Ethiopia, the first WHO edition (ICD-6) is currently being used which has a list of 150 illnesses (diseases) with the corresponding numerical codes. WHO has now published its 10th edition of the ICD code to respond to the dynamic nature of the medical field in terms of tracking new and emerging diseases. However, the Ethiopian ICD code list is not updated and is thus unable to capture data on diseases like HIV/AIDS and chronic diarrhoea. Therefore, statisticians or health workers are forced to use a code which they think represents these diseases.

At its outset, the primary aim of using the ICD was to help in ensuring health care providers and users of data to apply the same definitions, guidelines and rules in recording and reporting health data. Despite this fact, most of the health workers do not appreciate the availability of the ICD list and do not want to transform their diagnosis to the ICD code because of different reasons. A physician said:

> *I do not have enough time to change the diagnoses into ICD code. I should give priority for the patients who are waiting for me.*

Other physicians consider it as if it is not their job but that of the statisticians or the nurses and strongly object to fill out the ICD code column in the registers. In other cases, the physicians agreed to only fill out the ICD code leaving the diagnosis column unfilled. Since the RHB requests the monthly MM report by ICD code, statisticians are compelled to document the ICD code whenever it is left unfilled by the physicians. Related to this issue, a statistician at one of the hospitals said the following:

> *Even though I distributed the ICD code list to all physicians to refer it whenever they need, they do not want to change the diagnoses into ICD codes except one physician. When they leave it unfilled, I will document the ICD code. Actually, it is not difficult for me since I have been working the same job for long period of time (Statistician at Hospital, November, 2004.).*

Moreover, physicians' handwriting is another challenge for the statisticians to convert the diagnosis of the diseases to ICD code. Indecipherability of physicians' handwriting is taken as a normal thing by the staff even though it adversely contributes to the overall quality of MM data. This entails for the need of a standardised way of writing diagnosis in order to contribute to the improvement of the quality of data.

Currently, two types of MM data are being collected; for outpatients and inpatients. The regular and emergency outpatient MM data are collected and compiled separately. The primary data collection tools for these data are different in the hospitals and in the health centres. In the health centres, the outpatient MM daily tally sheet is filled out when a

person is diagnosed. The tally sheet contains data on: patient's card number, age, diagnosis, ICD Code and remark fields. The sheets are collected daily from each outpatient department and compiled in the monthly reporting format. Health centres collect data on outpatient visits only. Patients who need to be hospitalized are referred to hospitals and their data are recorded on the outpatient MM daily tally sheet as 'referred'.

At the hospitals, the MM data are collected from every ward and outpatient log books. The outpatient MM data are collected from the outpatient log books which were introduced during the implementation of a patient record system by WHO (See further discussion on the patient record system in the following section). The outpatient logbook-medical unit, out patient log book-surgical units and out patient log book-paediatric units are used in the different departments of the hospitals. The logbooks range from 72 to 82 cm in length However; only half of the page is being filled out. The excessive length of the logbooks, as shown in Photo 5-1, forces the physicians to design their own small and handy register books which they keep as their personal property. At one of the hospitals, the statistician explained the difficulty of collecting MM data as follows:

> *I'm not able to get full data from the medical eye Outpatient Department. One of the physicians is recoding data by his own register and locks it whenever he is not around. Therefore, I'm forced to send incomplete reports. However, at the upper level; they do not know that I'm sending them incomplete data (Statistician at Hospital, November, 2004).*

**Photo 5-1 Compilation of the outpatient MM data from the logbooks at a hospital**

**(Source*:* Field work at the health facilities, November, 2005)**

The admission register in each ward is the primary data collection tool for the inpatient MM data. Most of the registers are designed by the health workers in each ward and differ by the type of ward. Commonly, the registers contain data on: age, sex, sub-city, house no., bed no., card no. admission date, admission diagnosis, discharge date, discharge diagnosis and ICD code.

As we observed, the data collection procedures for the inpatient MM data differs between hospital wards and also from one hospital to another. In some hospital wards, the data are recorded 'on admission' and in others the data are recorded 'on discharge'. The former, has an impact on the completeness of the data. For example, those who follow 'on admission' registration, leave the discharge column empty until the person is discharged. In this case, patients are omitted from being counted for the month. This practice was explained by the medical director of a hospital, in which both types of registrations are being practiced, as follows:

> *I know that in my hospital the medical ward is registering 'on discharge' and the surgical ward is registering 'on admission'. Those who are following the 'on discharge' registration are not following a good procedure. You have to have a record of your patient when you admit it. Otherwise, there is no possibility of knowing the bed occupancy for a specific day. I would rather suggest the statistician to put mark for those the discharge date is not filled and to remember counting it with the next month data (Medical director, November, 2004)*

Even though the medical director suggested to the statisticians to count the person when he/she is discharged by making "reminder" remarks, the statisticians were not counting patients who were not discharged in the month that the data collection was taking place. The statisticians are considering the 'on admission' registration as a problem which leads them to omit patients' data and do not take any action even after realizing the significance of the problem. On the other hand, the bed occupancy rate of patients, which the hospital needs, can be collected from the patient's card if 'on discharged admission' is practiced to tackle the work practice problems. For the RHB, the 'on admission' registration data were considered to be more important by the health staff; the reasons for which we could not fully understand.

The other difference between hospitals, in MM data collection procedures, is on the primary source of data that the statisticians use to fill out the monthly reporting format. For example, at one of the hospitals, the statistician used the patients' card in which the ICD code is not expected to be documented, and instead filled in the inpatient registration book. Unlike the outpatient MM data reporting, for inpatient it is only one of the diseases (in case a patient has more than one diseases) that should be reported. This is because of the Total Length of Stay (TLS) that appears to be reported for each disease but not for each patient in the form design (see Appendix E.3). The primary diagnosis is what is chosen for reporting. Therefore, the statistician picks the primary diagnosis and changes it to ICD code by herself, which is helpful to avoid the problems of 'on admission' and 'on discharge' registration. However, it has impact on the data accuracy when the statistician selects the primary diagnosis and changes it to the ICD code as she does not have a medical background.

According to the MOH guidelines, a standard health centre has five satellite health posts and is a PHC unit that provides a package of public health and essential curative service to a population of 25,000 (MOH Ethiopia, 2002). Based on the PHC structure, health posts should send their reports to the respective health centres. The data are aggregated with the health centre data and sent to the SHD. Data processing at the facility level involves computing sums of data from different service delivery points to generate the monthly reporting formats and aggregation of the monthly reports to produce the annual and quarterly reports. Moreover, the statisticians calculate the monthly performance coverage from the annual plan and the monthly performance. The data processing is done manually using pencil/pen and paper or by using a calculator.

Photo 5-1 illustrates how data processing is being conducted in the health facilities.

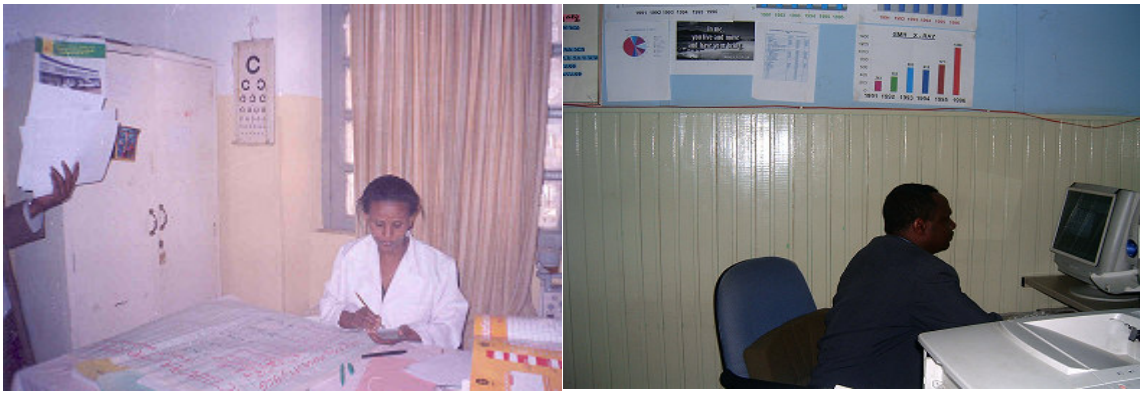


**Photo 5-2 Data processing in the health facilities of Addis Ababa region**

**(Left: health centres using calculator; Right: hospital using computer)**

**(Source*:* Fieldwork at the health facilities, November, 2004)**

The flow of information from the hospitals is not standardised. In principle, the five regional hospitals are supposed to submit all reports to the RHB. However, this research identified that the three hospitals (Yekatit 12, Zewditu Memorial Hospital and Gandhi Memorial Hospital) have been sending reports on Maternal and Child Health (MCH), Family Planning and Health Education activities from their MCH department to the Centre for Disease Control (CDC) team at the sub-city level, in addition to the program

experts at the RHB. The MM reports goes directly to the RHB Plan and Program Department.

At all levels, we found the staff that are engaged in data processing and reporting have never got training on how to process and analyze data. On the walls of the SHD and facilities, we often observed the performance coverage for each data element. For example, planned BCG vaccination vs performed BCG vaccination for each month, quarterly and yearly instead of the over all EPI coverage or BCG coverage. A nurse at the health centre said:

> *What is important to know for us is the performance coverage and that is also what I am asked to present by the administrator of the health center as well as by the people from the SHD…that is what I am doing now…to post it on my wall in addition to reporting for the people who need it (A nurse at the health centres, November, 2004).*

This shows the limited use of information at this level. This seems very much related to the current government civil servants' evaluation system called 'result oriented'. In this system, government employees are to be evaluated according to the work they perform against the plan. Therefore, we can say that the political context is adversely influencing the data quality by making the health workers to focus only on what is required by the government. A health centre medical director also gave another reason for the limited information use by saying:

> *I have a lot of things to do. I don't have time to analyze the data. To be honest, I do not trust the quality of data which is being processed by the 'statistician'. In addition, she does not have enough capacity to analyze the data and present it to me. This is caused by her educational background and lack of training. Because of these reasons, I can not use the data which are being collected even if I need to do so (Health Center Medical Director, October, 2004)*

In one of the hospitals, we were able to observe an encouraging example of data being collected for supporting local decision making activities.

> *I have made the statistician to collect morbidity and mortality data by each physician…I know that it is not useful for reporting. But, I use it for allocating the human resource by evaluating their performance. So this is just for my purpose. We shouldn't collect data just for reporting. (Hospital Medical Director, November, 2004)*

All the health centres observed during this research, did not have computers while each of the hospitals received one during the implementation of standard patient record system by WHO to track emergency cases. All the statisticians at the hospital also have basic computer skills which most of the health centre statisticians do not. The patient record system is an Access based application with a Visual Basic interface. The system was deployed in October 2004 at the statistics office of the five hospitals. The initial purpose was to facilitate the data processing, analysis and transmission activities of emergency cases only. However, after some time; the purpose was changed to cover all outpatient cases registration and entry. At this point, the statisticians resisted to use the system even if it was acknowledged by most of the health workers to have its advantages. A medical director a hospital expressed his feeling towards the system as follows:

> *The system was good to know the details of our patient and helps in the data processing. However, we have resource constraint. If there was resource (manpower and ICT infrastructure), the system would be implemented in each department and the work load at the statistics office might be reduced (Hospital medical director, October, 2004).*

Currently, the system is not being used by most of the hospitals for the following reasons:

*Shortage of manpower*: The data for the system should be collected from two registration books daily and entered in the system; one from the record office to fill out the patient details and the other from the outpatient department to know the diagnosis for that specific person. This job could not be done by a single statistician given the large number of patients who are seen in the hospital. In the current policy, one physician should see at least 35 patients per day and the total number of the data will be the multiplication of this 35 with the number of physicians assigned for the daily work.

*Lack of support*: The users did not have anybody to ask about the system whenever they faced problems.

*Length of the log book*: The registration books that have been introduced by the hospital system are too long, and not manageable for registration and entry. Because of its length, some health workers did not like to fill in all the required data.

All the above reasons emphasize the contextual influences on introducing a computerised system

In the above section, we discussed the data collection, processing and reporting processes at the health facility level (hospitals, health centres and health posts). The next section discusses the data, processing and reporting activities of the next level of hierarchy; the SHD.

- **Sub-City level: Sub-City Health Department**

In the 10 Sub-city administrations, there is a SHD which is responsible for the health service activities including the HII. There are two teams at the SHD; CDC and Health Serviced. Each team is comprised of a team leader and health program experts. The Health Centres and Clinics Supervision and Health Information Desk is an independent unit having one staff person[5]; a statistician. The statistician has an additional responsibility, described in his/her job description, of performing the collection, aggregation and reporting of data from health facilities. Except one (public health nurse), the nine statistician are clinical nurses. All of them were working in the health facilities before the new structure was established. All these staff have been trained in Microsoft

[5] Through out this thesis, this person is called statistician to keep consistency with the lower and upper level persons who are engaged in the same data handling process and for purposes of simplicity. In reality they are not called as statistician but Health Centre and Clinics Supervision and Health Information Desk staff.

application software (MS Excel, MS Word and MS Access) but not on how to process and analyze health data. One of them said:

> *I did not get any training on how to process or analyze data. However, I got a computer training which was sponsored by the Sub-city Health Department. Now, I'm learning other programming languages….my main problem is lack of computer.*

The health program experts in CDC team receive reports on MCH, Health education, IMCI, HIV/AIDS, STDs and TB & Leprosy. Each expert in this team aggregates and sends reports that he/she is responsible for. The other team, Health Services, receives data on MM, diagnostic activities and drug distribution. These data are aggregated, by the statistician and transferred to the Plan and Program Department at the regional level. Reports are received monthly, quarterly and annually from each of the health facilities.

Our investigation into key resources required for data processing and analysis shows that none of the statisticians have got computers. This can be understood as a result of the new structure (Health Centres and Clinics Supervision and Health Information Desk) and the staff appointment for this position. However, at least, one computer was available either at the manager's or at the secretary's office which was mainly used for secretarial purposes. The program experts and statistician use calculators to facilitate the manual data processing. They indicated that the MM data processing takes 25-30 minutes of their time. In view of the fact that this work is done once a month, the time seems to be insignificant. However, as it is an additional job, something which can reduce this time taken was described to be important. There was at least one printer in all the SHDs. Unlike our experience in Oromia region, where we had difficulty to make such an assessment, the urban nature of the city contributed to the availability of telephones in all places. However, in some places, the health program experts and the statisticians indicated they had usage limits for telephone and paper, and the excess to which had to be paid by the staff on a personal basis. As a result, it was not easy to communicate with health facilities frequently about incomplete and late reporting.

In addition to the flow of information with in the health care sector, quarterly reports were also made to the Sub-city Capacity Building Department using the format that the department distributes. At this level too, the data are analyzed to know the performance coverage and top ten diseases. The uses of data are also mainly limited to measure the performance against the plan and to send it to the upper levels to show the work done. Tables, bar charts and pie charts are used to present these data.

In the review meeting which is held every three months, the SHD people discuss the performance of the health centres based on the performance coverage data. If performance is significantly lower than the planned one, they discuss possible problems and actions to be taken. Plans for the next year are based on the performance of the current year. However, we found this performance coverage calculation as very detailed. For example, in one of the hospitals performance report, we found a plan for HIV/AIDS total patients, which we feel, was not important (See Appendix E.5).

Minimal use of indicators was also another contributing factor for the limited use of information. All SHD managers indicated that they were not using indicators. For example, one of the managers said 'till now, we don't use any indicator' to answer our question of 'which indicators do you use at this level? There was also limited understanding of what means an indicator, and we identify this lack of knowledge as an important issue requiring further investigation.

In the next section, we discuss the data processing and reporting activities at the regional level.

- **Regional level: Addis Ababa City Government Health Bureau**

The organization of the departments in the region is a reflection of the organization of the departments at the national level. However, recently, the Hygiene and Environmental Health Department was taken out from the RHB and re-established as Beautification Agency under the City Government Council. The Plan and Program Department is

responsible for the Regional HII. The region has a statistician who has a diploma in statistics and also serves as a network administrator for their Local Area Network (LAN), in addition to performing the information processing activities. The LAN is used for the sharing of files and Internet. The Plan and Program Department gets MM data from the statistician at the SHDs and the Regional Hospitals on a monthly, quarterly and annual basis.

Other types of reports are received by the health programs in the Family Health and Disease Prevention and Control Departments from the SHDs and regional hospitals. The health program experts, in turn, prepare multiple copies of the reports by compiling all the received reports. After all the reports are signed by the team leader, he/she sends one copy to the respective health program team/expert at the national level and other copies for WHO, UNICEF, UNFP, Ministry of Finance and the Plan and Program Department at the MOH. One copy is kept at the expert's office. Reporting is done quarterly, biannually and annually. In addition to these, reporting is also made to the City Government Council every quarter.

As it was observed, each expert has state-of the-art computers that are used for data processing, and storage purposes. NTCP-MIS, EpiInfo, surveillance system and MS Excel are the applications currently running. We briefly discuss each of them:

**NTLCP-MIS***:* The National Tuberculosis and Leprosy Program-Management Information System (NTLCP-MIS) is used for data entry and analysis of the quarterly Tuberculosis and Leprosy reports. The system is implemented using Epi Info (version 6.04) software designed by the US Centre for Disease Control and the WHO. The NTLCPMIS is designed to run on a single stand-alone PC. It has the 'Export to Excel' functionality which allows the user to view the graphical presentations. The system does not produce user-defined reports such as the national quarterly TB and Leprosy reports. Hence, the aggregated data have to be copied from the excel report to the paper format manually for reporting purposes.

**EPi Info**: Epi info is used for data analysis and as a storage tool at the regional and national levels, and is quite uniformly acknowledged by health care providers for its capability to generate maps. In the Diseases Prevention and Control Department, the surveillance expert enters the IDSR data into this software for data processing and analysis.

**Epidemiological surveillance system***:* This is a system developed by MOH with WHO sponsorship. It is specifically designed to monitor surveillance data. The system is designed on an Excel spreadsheet. At the time of this research, the system was being installed for the surveillance experts at the sub-city level so as to transform data electronically between sub-city CDC team and the IDSR expert at the regional level

**MS Excel:** Microsoft Excel is used as a data analysis and storage tool in all the departments where specific applications are not developed

The presence of the LAN was not found to help the integration of these technically fragmented reporting systems since the experts wanted to work independently and no one initiated coordination among the parallel systems

Figure 5-3 summarizes the information flows that are discussed under each level and presents the overall information flows for the region. The figure shows the fragmentation (technically and in paper) of the reporting system by various components. Although, it is not reflected in the figure, a better coordination in reporting was observed at the health centres than at the hospitals, and at the sub-cities and region levels. At the health centres, each department prepares monthly reports of their own activities and these are consolidated into a single report for the health centre by the statistician. They also have a strict deadline for the submission of reports to the statisticians. In the hospitals, as described earlier, there are no clear data collection procedures. In some hospitals, the

statistician was responsible for collecting all data from every register while in others he/she is responsible only for the MM data collection.

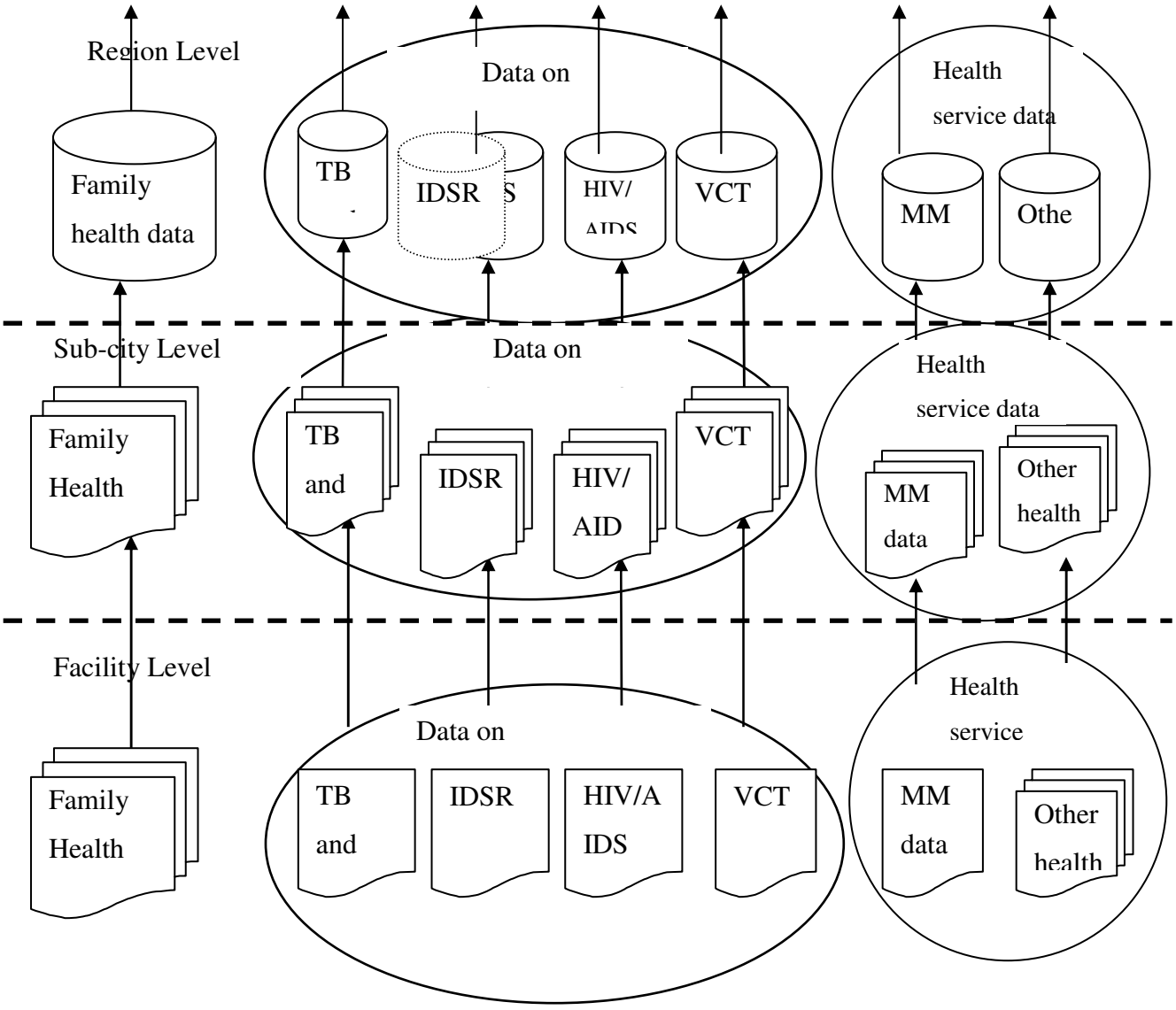



**Figure 5-3 The vertical flow of data with in the health care organizational structure**

**(Source: Fieldwork from June 2004-January 2005)**

As the figure shows, data are reaching the RHB in a fragmented manner. Some of the data like on Surveillance, HIV/AIDs, STI, and VCT are directly reaching the RHB

without aggregation, while the Family Health and Health Services data are aggregated by experts at the sub-city level.

In summary, the situation analysis of Addis Ababa region can be summarized as follows:

1. There was limited to no standardized data sets, data collection instruments and data collection procedures
2. The reporting system was fragmented both in paper-based and also the technical system (different software applications).
3. The shortage of human resources was found to adversely affect the efficiency of the existing HII.
4. Even if there was specific person at all levels to handle the information processing activities, most of them had neither a medical nor statistical background. Many posts were vacant.

However, despite the fact that the existing HII had many constraining factors, the health workers were trying to do their best by improvising and using their 'gut feeling' to do things. Work goes on, and the HII has been providing the managers with information.

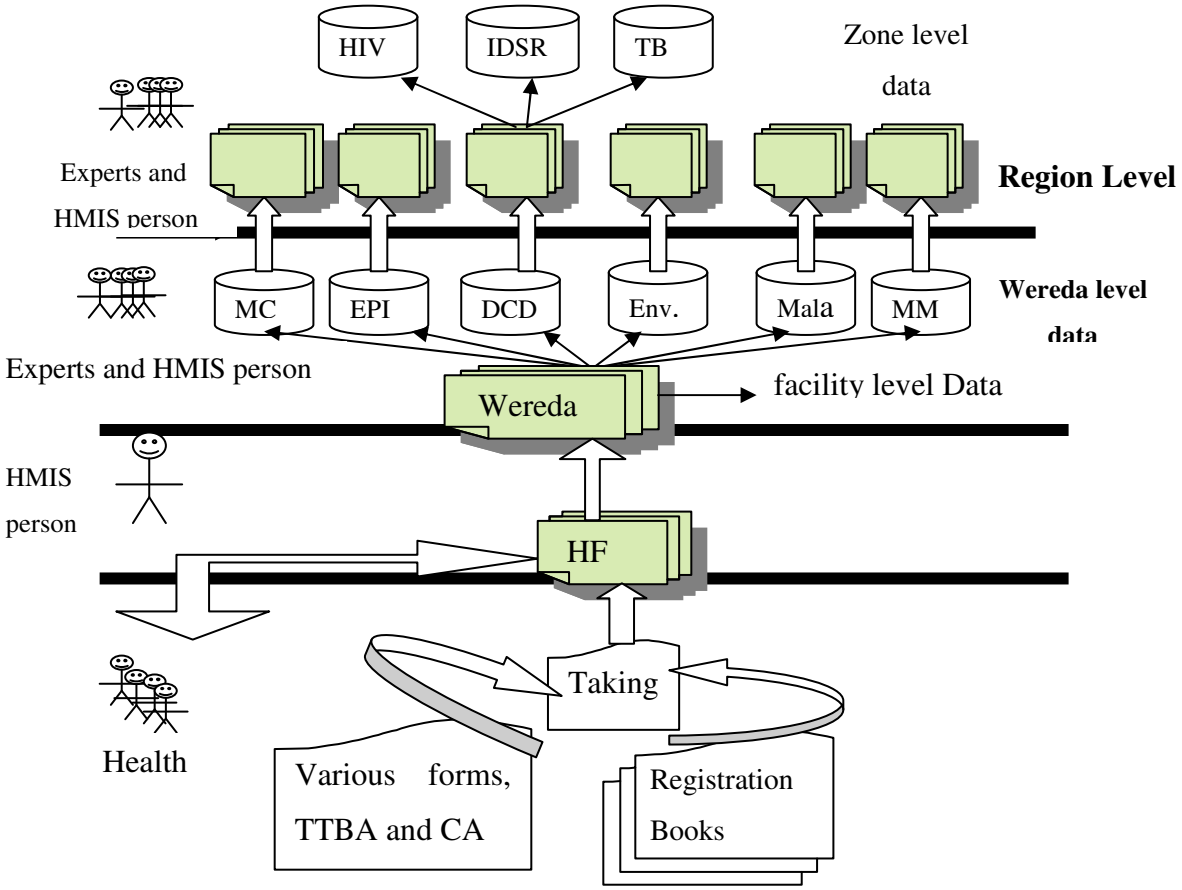
## 5.4 Oromia region

- **General overview**

The organizational structure of the Oromia Regional Health Bureau (ORHB) differs from the Addis Ababa Health Bureau as it is organized in four levels; Region, Zone, Wereda and Health Facility. Under these levels, there are various horizontally organized national programs such as TB, Leprosy, and HIV/AIDS national programs. The flow of the health data reports is similar to that of the Addis Ababa Health Bureau. It starts at the health facility level, and flows successively up the four higher levels (wereda, zone, RHB and MOH). In some exceptional cases, weredas send reports directly to the region in accordance with recent structural adjustment. The structural adjustment, which is part of

the government's decentralization policy, has provided greater authority and responsibility to the weredas.

At all levels, a significant number of health workers are involved in the routine health reporting activities. The number of health workers reporting and processing health data increases as we move up the administrative hierarchy. For example, during our fieldwork, we visited a health facility staffed by one person, and at the regional level there were ten people for the same work. The number of staff members has to increase at regional level as there is the need to conduct more detailed data analysis at the higher levels. However, as the burden of collecting and collating data rests on the shoulders of health facility workers, it can be argued that there is an uneven distribution of human resources in the health hierarchy. Figure 5.4 illustrates the general health data processing and flows in ORHB.




HF - Health Facility
TTBA- Traditional Birth Attendants
CA - Community Agents
MC- Maternal and Child
EPI- Expanded Programme for Immunization
DCP- Disease Control and Prevention
Env- Environmental Health
Mala- Malaria
MM- Morbidity and Mortality
IDSR- Integrated Disease Surveillance
TB- Tuberculosis

**Figure 5-4 Data processing and information flow in the Oromia region**

- **Health facility level**

Availability of various infrastructure facilities, resource allocation, and staffing in a health facility depends on its type (hospital, health centre, clinic and health post) and its location (rural or urban). Hospitals and health centres enjoy relatively better infrastructure and human resource allocation than health posts and clinics.

**Figure 5-5 The road which takes to Gimbichu WerHO**

During the fieldwork, it was difficult to reach some rural Wereda Health Offices, we were able to witness that the gravel roads need heavy maintenance. Figure 5-5 illustrates this fact.. In such places, it is not surprising if reports are sent late as there is transportation problem. In addition to the difficulty faced while travelling on the bumpy roads, lack of regular transportation services, especially in the areas where health posts are located, aggravates the problem. One of the health post health worker said:

> *When there is a need to go to the WerHO for different purposes including reporting, I have to wait up until market day to get transportation. Sometimes, I use the vehicle of the wererda Agriculture Office if by chance they come here to visit their work sites (Health worker at health post, December 2004).*

This is a good example that shows how health workers go extra mile to send reports on time. As the health worker mentioned above said, they are doing their best to accomplish their tasks by being creative to use different ways of transportation. Of course, waiting for the market day for instance, delays the reports; and most upper level staff members have complained about it.

Moreover, although health posts are the nearest and most accessible health facilities for the community, almost all of them do not have access to telephone service. Accordingly, the staff maintains communication and data reporting through individuals they know or in informal ways. Concerning this issue, one of the health post staff said:

> *I send the report through somebody working either in the near-by school or Agriculture office when they go to Gimbichu; or I send it through somebody whom I know on the market day (Health worker at health post, January 2004).*

Contrary to the situation at health posts, most health centres and hospitals have direct telephone link. However, this is not easily accessible to health workers, who are engaged in the HMIS activities as it is mostly used for administration purposes.

In general, most of the health facilities in Oromia do not have adequate human and non human resources. The problem is worse in rural health facilities. Resource supplies such as drugs, stationery, data collection and reporting forms, and registration books are scarce, particularly in health posts and clinics. Table 5-2 shows the distribution of health personnel in each health facility.

| Type of Health Facility | Average Health Professionals work in the Health Facility | Qualification |
|---|---|---|
| Hospital | 51 | Special Doctor, Doctor, Nurses, Health Assistant, PHC workers |
| Health Center | 13 | Nurse, Junior Nurse, front line workers |
| Clinic | 1-3 | Nurse, public health worker, health assistant |
| Health Post | 1-2 | Primary health workers |

**Table 5-2 Health staff distribution in the visited health facilities in Oromia**

**(Source: Field work, November 2004)**

Most of the hospitals and some health centres visited were equipped with computers (Pentium 3, Dell, 128 MB RAM) that have been acquired through donations. They are mainly used for writing and compiling reports and malaria data processing.

As the number of health professionals is very few in the health posts and clinics, they have wider responsibility than professionals in the health centres and hospitals. Specialization increases when one goes from health post to hospital. In hospitals a particular health professional is assigned for a specific health service. Also hospitals and health centres are well equipped with modern medical equipment. The use of modern and sophisticated medical equipment helps reduce the workload on the health professionals. More materials are also available in hospitals and health centres to provide health education to the community.

**Photo 5-3 Video tape health education in Bushefetu hospital in Oromia region**

One of the major tasks of health workers working in health posts and clinics is to provide health education to the community as shown in Photo 5-3. Often the health workers have to go further away from their work place. Consequently, they view the data collection and reporting as an additional burden feeling that they are wasting their time.

A health post staff, working in the Koka Health Post in Gimbichu wereda, located in a remote area where there is no electricity and transportation facilities, described her daily work and responsibilities as follows:

> *I have to walk for 1 or 2 hours to reach to the areas where I provide health education to the community and vaccinate those who need to be vaccinated. Dealing with patients, providing drugs and delivery service, consulting and educating women on family planning, collecting data from the registration books and preparing monthly reports and sending it to wereda are also my responsibilities(Health worker at health post, January 2004).*

From what this health professional said, it is easy to understand how heavy the workload of health post/clinic workers is. Moreover, the poor infrastructure in such remote rural areas makes their work more challenging and difficult. We were able to observe that as a result of this heavy workload, the staff in most health institutions, except in hospitals, are less dedicated to collect data and write reports. Even though, the hospitals like in Addis Ababa health facilities have a position for statistician, it was mostly found to be vacant. As it has been stated above, usually, besides their routine work, the HMIS activity is the responsibility of health workers. In addition, similar to the situation in Addis Ababa, there was no procedure or manual to refer to on how to collect, process, and report data. A clinical nurse assigned for the HMIS work in a hospital describes how the data collection process and reporting activities are being carried out as:

> *I have been doing the HMIS activity in addition to my routine work since last year. Health workers working in different sections like MCH and the Family Planning prepare their own report. And either they give the report to me to compile and send it to wereda or they give it directly to the wereda health office which is located in this compound (Clinical Nurse works for HMIS at hospital, December 2004) .*

The nurse described the traditional way of doing things in the absence of formal work procedures and standards. In such cases, the comprehensive hospital report is not compiled by one section; rather it is disorderly handled by different sections. Furthermore, the HMIS activity is carried out through experience gained traditionally on the job, and is not reinforced by either formal or on the job training. One of the health program department heads of the ORHB told us her experience of recording health information while she was working in health facility as a physician as follows:

> *When I was working in a health institution, I never gave attention to recording health information rather I focused on treating patients. I did not know the importance of the information at all. I realized this after I came here to and held administrative position. However, I did not get training related to HMIS either from formal education or short-term training. (Department Head, ORHB, December 2004).*

As it has also been identified in Addis Ababa, absence of HMIS training was identified as a major problem contributing to the poor quality of reports. This needs serious attention and thus improving the HMIS should be considered as one of the priority areas.

Bulky and old primary and secondary data collection materials are used in the health facilities to collect and report health data. More than seven types of registration books serve as primary sources of data for the 26 page secondary source of data registration book. Photo 5-4 shows a photograph of these books.

**Photo 5-4 Registration books at Wonji clinic in Adama wereda**

As described in the case description on the current national HII situation, the data collection registration books were introduced in 1978. They have been subjected to various local modifications by different health professionals who run different health programs with out any coordination. The problem has become worse as the primary data collection registration books were forgotten to be updated while the corresponding secondary data collection books were changed and renewed. As a result, most of the registration books, we observed, were outdated. Some field names were cancelled and others were overwritten by different health workers at their will. We observed such practices in nearly all of the visited health facilities illustrating the adaptability of the staff.

Photo 5.5 is the photograph of the "Sick Children Registration Book" taken as an example to demonstrate how data quality is affected by failure to update the primary source of data inline with the secondary source of data.

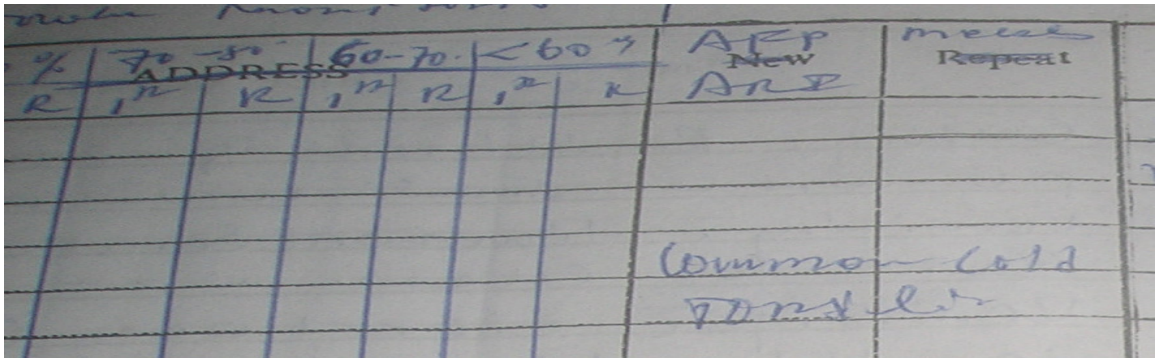



**Photo 5-5 Sick children registration book found in one of the visited Hospital**

**(Source: Field work, Bushefetu Hospital, December 2004)**

There is limited coordination amongst health programs to update the old formats or to introduce new ones. That has led to duplication of data elements in the reporting formats. For instance, we found the same type and number of contraceptives in both the contraceptive inventory and the family planning reporting formats.

In general, reporting formats are introduced and modified at different levels, areas and times by different bodies regardless of updating the primary data collection registration books, with out checking the data collected and reporting formats, and with no concern to ensure uniformity. Consequently, the data collection and reporting formats have become very cumbersome, complex, and fragmented.

Similar to that of Addis Ababa, data collection and compiling of reports starts with the filling out of the registration books, tally sheets, and other forms with information obtained from the health service delivery. And this is followed by preparing and sending the reports to the WerHO. Concerning the data collection and processing activities one of the health workers discussed:

> *I collect the monthly data from different sections of the hospital. Before I start collecting the data, I check in the registration book the date on which the previous month's report was compiled. Then starting from that date till, say, yesterday, I collect data from the registration book on a piece of paper, When I finish, I write the date at the end of this month's report (Health worker at hospital, December 2004).*

All health facilities do not have a fixed date to start and conclude the data collection though they have a deadline for reporting. We observed different dates written at the end of the reports of different months. Therefore, the day on which the data is collected determined by the data collector which results in irregularity both within a health facility and amongst health facilities.

The HMIS activity at the health facility level is entirely paper-based except for the Malaria Programme. NGOs have played a significant role in supplying the required resources to their area of intervention. The malaria application programme named Prospective Malaria Data Processing is one of them. The programme, funded by WHO, is a Microsoft Access based application programme developed by a local IT expert. Currently, it is being used in only three health and two malaria centres for malaria data processing and reporting.

- **Wereda level: Wereda Health Office**

The strategic plan of the region underlines the need to address the problem of inadequate resources allocation for weredas; but it gave less emphasis to the organization of Wereda Health Office (WerHO) during the establishment of the regional state (ORHB, 2003). Consequently, we found out that most of the wereda health offices are staffed by only two persons.

Out of the fourteen weredas in East Shoa zone, only six of them have computers, which are found either in the office of the WerHO head or the secretary. Most say that this is

inconvenient for work as the computers are not easily accessible. Like it is in the health facilities, the computers in the WerHO's are also mainly used for word processing. All computers have been donated by different NGOs except one, which has been bought by a WerHO. Two weredas have recently received computers from the ORHB for the purpose of implementing DHIS. The available computers and its use across weredas for the East Shoa zone is shown in Table 5-3.

| Wereda | Computer type | Placed | Service Period | Assigned For | Acquired from |
|---|---|---|---|---|---|
| Shashemene Rural | Pentium III | Secretary Off. | > 5 year | Word Processing | NGO |
| Akaki | Pentium IV | Secretary Off. | 2 year | Word Proc. | NGO |
| Shashemene Urban | Pentium IV | Secretary Off. | 1 year | Word Proc. | NGO |
| Adama | Pentium IV | Secretary Off. | > 3 year | Word Proc. | NGO |
| Bushefetu | Pentium IV | Head Office | New | Word Proc. | NGO |
| Siraro | Pentium IV | Head Office | New | Word Proc. | Govt. Budget |
| Lume | Pentium IV | Head Office | New | DHIS | ORHB |
| Fentale | Pentium IV | Head Office | New | DHIS | ORHB |

**Table 5-3 Computer facility in Eastern Shoa Zone weredas**

**Source: (Field work, October - January 2004)**

In each wereda, there is a statistician position under the Plan and Program section that is responsible for HMIS activities. The educational background of the HMIS person[6] ranges from high school to diploma level. Here also, like that of the health facilities, the HMIS activity is carried out based on knowledge acquired from work experience, and most have never received training on the collection, processing and use of information including basic computer knowledge. One HMIS person said:

[6] A worker who is responsible for data collection, processing and reporting activities

> *I have never attended any training in relation to HMIS. No body worries about HMIS so why do they organize training for us? I wonder if you are here to do something to improve HMIS. Many workshops and trainings are conducted in the region on different health programmes but not on HMIS (HMIS person, WerHO, August 2004)*

The HMIS person has the responsibility of receiving reports from health facilities, and to collaborate with the workers at the health centres in compiling data and checking its validity. In addition to the preparation of various reports and plans, he/she is also responsible for supervision, health education and inspection in health facilities. The HMIS persons are busy doing the above-mentioned activities; and usually prepare monthly reports only when the deadline is approaching. Clinical nurses or other staff members of a health facility are forced to do HMIS activities when the statistician position becomes vacant. They are expected to perform these tasks in addition to their daily routine work. A WerHO staff, who had experienced such an assignment, discussed this issue as follows:

> *I am a pharmacist. Due to the new structural change, I am also assigned for HMIS activities in addition to my routine activities. I have been asking the previous statistician to learn the job (Pharmacist, WerHO, August 2004).*

The HMIS activities are also being hampered due to shortage of reporting forms, and the absence of a photocopy machine used to copy form required to be distributed to health facilities. Concerning this one of the HMIS persons told us:

> *We neither have a photocopy machine nor adequate budget to duplicate the reporting form and distribute it to the health facilities. Even if there is enough budget, I have to travel 35km to get photocopy service. Previously, it was good since the zone was used to give us reporting forms. However, now due to the new structure this practice has been changed. (HMIS person,WerHO , August 2004).*

The work of the HMIS person begins with receiving data from the health facilities. The HMIS person receives data from health facilities. Due to the shortage of human resources at the WerHO, the HMIS person distributes the data to staff members at health centres

and they help in the monthly reporting and processing activities. The HMIS person discussed the involvement of the health centre staff in reporting activities as follows:

> *When I receive the health facility report, I distribute it to three staff members of health center (MCH, FP and ENV health) to compile the morbidity and mortality data that is finally handled by me. They deal with their respective health programme reports and send them back to me. Finally, I check and compile report of all health programmes to be sent to zone (HMIS person, WerHO, August 2004).*

The HMIS activities in the weredas, even though some have computers, are mainly carried out manually. The computers are mainly used for word-processing.

It is mostly difficult to correct errors and mistakes made by the health facilities, due to lack of proper infrastructure facility. Most of the time, errors are corrected according to the understanding of the HMIS person at the WerHO. Usually, corrections are done based on previous experience and only when the staff members from the health facilities visit the WerHO for other purposes. Concerning the communication problem between the health facilities and WerHO, the wereda head said:

> *It is usually difficult to go to health facilities for supervision particularly in this wereda. Most of the health posts are located further away from here in remote areas where there is poor road and transportation facility. Sometimes when we go to the health posts, the person may not be there or he may be out for vaccination campaign or for some other work. For instance, last time, we went to a health post and found it closed. The people told us that the health worker was sick and never showed up for the last two months. This means that we were not getting the information we need. Currently, we hold a monthly meeting with health facilities' managers that may some how help to address such problems. (Head, WerHO, October 2004).*

Most of the weredas use the facility's data to prepare reports to be sent to the next level with out much local use. The WerHO head mentioned the budget constraint as the reason behind not using the data locally. Resources are allocated based on previous experience and the available budget. Routinely collected information has to do little with budget

allocation. Therefore, health facilities reports are not analysed, rather, they are sent to the next level after compilation.

Availability of infrastructure facilities and human resource allocation differs from one wereda to another. In some weradas, the road, electricity and communication facilities are in bad shape. For example, Gimbichu did not have electricity even for the WerHO. There is no telecommunication service and it is difficult to get smooth transportation service. Human resource allocation is by far better in weredas where there is better infrastructure than in weredas with poor infrastructure facility. For instance, five health workers were assigned in Adama WerHO, which is the biggest town in Oromia region, while in most of the weredas the WerHO were staffed by only two persons. The identified problems regarding data collection, processing and reporting activities worsen as we go from weredas with better infrastructure to those weredas with poorer infrastructure. For example, the reporting forms were more scarce in weredas with poor infrastructure facilities.

- **Zone level: Zonal Health Desk**

East Shoa ZHD enjoys the availability of better infrastructure facility as compared to other ZHDs. Telephone and fax facilities are found in the head office and also in some other offices. However, the HMIS unit lacks even a PBX line in its office though the job by its nature requires active communication. Hence, the unit is forced to use the PBX line available in the nearest office.

Desktop computers, printers and photocopy machines are commonly found in most of the offices. The staff members get easy access to these machines and they have basic computer knowledge gained through formal training and experience. However, some of these computers were outdated and often not working. It was also mentioned by the staff

that they should wait at least two months to get the computers maintained as there was no IT person in the ZHD. Regarding this issue the HMIS person said:

> *Some of the computers are old and not properly working. Moreover, there is no qualified company here in Zeway town to that repairs electronic equipment. For instance, last time we brought a guy from a private company for maintenance work. He was here for the whole day but he could not maintain it(the computer). We have to go to Nazreth or Addis Ababa to have our electronic equipment maintained (Staff, ZHD, November, 2004).*

The ZHD is organised in three teams; Health Service, Health Program, and Health Planning. These teams play a significant role in providing preventive health services such as mass vaccination, health education, and training on environmental health related matters. The ZHD also serves as a bridge that links the WerHO's with the ORHB. However, it does not play any role in defining resource allocation and budget for the weredas.

Similar to that of Addis Ababa, the monthly reports that are received from the weredas are separated into different health programmes and processed independently by the corresponding health programme experts at zonal level. Each health programme expert enters programme specific data to his/her computer; and processes and reports the data independently. Each programme coordinator uses a designed Excel application sheet which is similar to the paper form for data processing.

The coordinators, including the HMIS person, send the printed copy of the report to their respective reports to the RHB. There is no coordinated way of sending these reports. Usually, one of them may collect the different reports and take them to the RHB when he/she goes to Addis Ababa or they may send it independently through individuals going to Addis Ababa.

The HMIS person, in addition to the routine health reporting, receives the quarterly report from all programme coordinators of the zone and the same report from the weredas as well. This leads to a duplication of information due to the absence of coordination. First,

the wereda quarterly reports are prepared by both the weredas and health programme coordinators of the zone. Secondly, two types of zonal reports are produced within the zonal health office quarterly by the HMIS person and by each health programme coordinators. Simply speaking, this is wasting resources and duplicating efforts.

For a three-month period (July-Sept. 2004), the data from East Shoa Zone and some other zonal reports were analysed to gauge the general data quality. We randomly browsed the reports to see their clarity, completeness and accuracy. The reports were found to be incomplete, with calculation errors, and absence of uniformity in the use of language. Under normal circumstances, the monthly reports are reported in English so as to maintain the uniformity of the technical medical terms. However, we found some reports written in both Oromifaa and English languages. This has resulted in a lack of uniformity and increased inconsistencies. We also cross checked and compared the wereda paper report with the zonal excel designed sheet and similarly the zonal paper report with regional excel designed sheets and we identified some mistakes made while copying the data and important details missing like wereda and health facility information. For example, we checked the December 2004 EPI paper report of the pilot zone against the zonal and regional Excel designed sheets. In the zonal excel sheet, there was no information regarding health facility while the wereda paper report has and also in the regional excel sheet did not contain even wereda level information. Moreover, the generated report using excel does not give meaningful information for decision maker (See Appendix E-8).

- **Region level: Oromia Regional Health Bureau**

The ORHB is found in Addis Ababa with better infrastructure facilities as compared to the ZHDs. The bureau has two dial-up connections, which will be improved by laying down the LAN that would be shared by all staff in the near future. The Bureau has also an ambitious plan of connecting all the ZHDs with the RHB through funding from the Ethio-Italian Cooperation. When the remoteness of the RHB from the ZHDs is considered, the

realization of this plan is important to get timely reports. The HMIS team leader discussed this project as follows:

> *All the necessary equipment and accessories have been purchased and distributed to all zones. The major aim of this project is to make the bureau's communication with zones smoother by establishing wide area network. In addition to the local and wide area networks, making Internet service available is also a major mission of the project. (HMIS team leader, ORHB, November 2004)*

This effort may solve the existing communication problem, which is caused by the vastness of the region and poor transportation facilities.

The ORHB is organized under five departments or services (See Appendix D.3). Out of these, three departments and one service are included in this study. These are Malaria, Women Affairs and Family Health, Disease Prevention and Control Department and Planning departments.

The HMIS unit is organized as a team in the Planning Department with four staff members; one team leader, an expert and two statisticians. However, in most cases one or more of the staff members are missing and the team doesn't work with its full capacity. One of the experts at the HMIS said:

> *The team is always in-complete, mostly, it is run by two staff members; sometimes it is run by only one. Now, we are two in the team. I have first degree in economics while my colleague is a high school graduate. I am also new for the job, so I need some time to understand the system (Expert, ORHB, November 2004).*

The planning Department head, who was highly involved in the implementation of the DHIS, left the organization while we were doing this research. The expert who gave us the above quoted interview has also recently left and joined a university to continue his second degree. During various discussions they held with us, the team members also complained about the unfair resource allocation and limited training opportunities in the HMIS unit, as compared to other teams. A staff member said:

> *No body wants to work for HMIS, if I am asked to work for HMIS with two grade higher level position, I would prefer the lower position in the line programmes teams. Because if I work in the line programmes, I will have opportunity to participate in short and long term trainings, workshops and to attend meetings which would help me to upgrade my knowledge (Staff, ORHB, November, 2004).*

This perceived unfairness has diminished their motivation for the work. Almost all the ORHB staff has basic computer knowledge and use computer for data processing and storage. Excel and Word are the widely used applications in the day-to-day activities of the RHB.

Monthly, quarterly, semi-annual and annual reports are generated and distributed locally and also to external users. Despite the presence of the HMIS team, similar to that of Addis Ababa, the routine health reporting activities are handled by each health program. Regarding how the data are processed at the regional level an expert from the bureau said:

> *Preparing monthly report does not take me much time. When I receive the monthly report, I just simply write it on the computer using Excel application program. From there I can generate quarterly, semi-annual and annual reports. I have already the designed sheets that contained formulas to calculate each case (Expert, ORHB, November 2004).*

Even if the expert tries to simplify the routine health reporting activities, the generated reports require further improvements. The reports contain only aggregated number of cases, and are not analysed and interpreted. Questions like in which areas of the zone (rural or urban), in which weredas of the zone and, at which type of health facility (Hospital, HC, Clinic and HP), can not be answered by the existing zonal or regional reports, although they have detailed information. As a result, it is difficult to use these reports for decisions. Nevertheless, the reports are presented in review meetings to approve budget and plans. For instance, the EPI report of the region does not tell at which wereda the BCG was given. It doesn't also tell whether it was given in rural or urban area. Moreover, the EPI data showed discrepancies when we cross checked it with the wereda and health facility reports. The bureau enters data into the excel sheet by categorizing it in age, as for example BCG 0-11 and BCG 12-24, which is not the case

when we see the wereda paper based reports. For example the Gimbichu Wereda, December 2004 EPI data in paper report is "BCG" 250 where as this data in the zonal excel sheet is treated as "BCG 0-11", 250, and "BCG 12-24", 0. Even if the wereda data does not give any clue about for which age the BCG is given, the zonal experts simply take it as BCG 0-11.

Regarding the EPI data reporting, we were also able to identify three ways of data collection that negatively affected the data quality. Some reporting forms contain only BCG as field names, so that the dedicated person fills in all the BCG data under the BCG field name by disregarding the age groups. However, when the data comes to the bureau and zone, it is regarded as "BCG 0-11". Some other weredas send the BCG data as per the bureau's requirement by age category and other weredas fill in all the BCG data under BCG 0-11 age field name even though there is BCG 12-24 field name. This shows how the persons responsible are often indifferent to data quality even if the mistakes are simple that can easily be corrected. The fragmented reporting forms and the absence of procedures on how to use the reporting forms mainly cause these discrepancies.

The staff of ORHB complained about the inadequacy of information which is available in the zone reports. One of the experts discussed this issue as follows:

> *Our problem regarding the reports of the zones is that; they do not include wereda level data. Zones send report that contains the name of the zone at the top of the report and fill out each case like first ANC, 20; second ANC 30 and so on. We need to know the wereda level data that is usually required by different bodies but we don't have it. However all this information is available at the zone health office (Expert, ORHB, November 2004)*

This problem is the result of sending reports by just simply aggregating data, which does not help for decision-making.

There is no detailed analysis being done in any of the health offices to generate meaningful information for action. In most of the regional bureau offices, we observed outdated charts and graphs. But, we also have observed some efforts by individuals to

post recent graphs and charts on the wall that help to measure data quality and show the status of the health service. This effort depends on the commitment of individuals, their experience and education status.

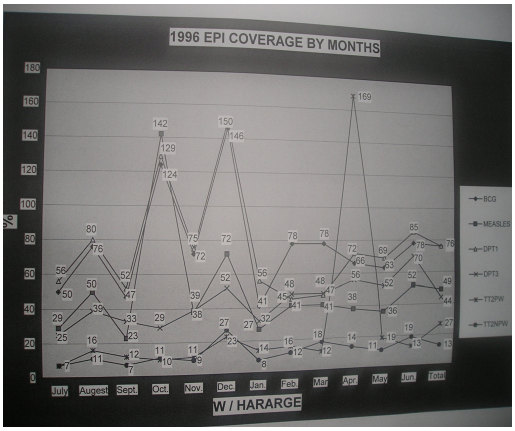



Figure 5-6 shows a photograph taken of the wall of MCH office in the bureau, which shows the annual EPI coverage of the region by zone on a monthly basis.

**Figure 5-6 1996 (2004 G.C ) EPI Coverage by Months**

All the departments send quarterly reports to the Planning Department and the MOH. Furthermore, reports are presented at management and review meetings. The frequency of reporting at the regional level is mostly on a quarterly basis except EPI reports, which are sent on monthly basis. The HMIS team prepares and distributes quarterly, semi-annual and annual reports of the region horizontally (across the departments), vertically (to the health hierarchies) and to external users such as WHO, UNDP, Ethio-Italian Cooperation organization, and other government and NGOs.

These massive volumes of reports are stored in different offices, in a rather ad-hoc manner. There is inadequate space to store these reports in a systematic way making it difficult for easy access and retrieval. The Photo 5-6 shows the storage system reflecting the random way in which files are stored.

**Photo 5-6 How files are organized in the office**

The statistician from the bureau and wereda commented on the bulkiness of the reports as follows:

> *I do not know where we are going to put the following year report. I tried to transfer the old report to store but I could not do that since there is no place even in the store. There are too old reports in this cabinet that should be discarded. They are not necessary at all.(Expert from ORHB, ORHB, December 2004).*

One of the ORHB staff discussed the problem of data retrieval in the following way:

> *Getting the previous year report and information is difficult in the bureau, since it is not organized in a systematic way. I think there is a need to improve the filing system. For instance, recently, I wanted to get the top 20 diseases of the last two years but I could not manage to get it. I have asked the HMIS team to help me, they are looking for but I do not think they will be able to find it. However, they told me that your system [DHIS] will help to handle this. We really need to know the top 20 diseases (Expert, ORHB, November, 2004).*

In general, the practice of using information locally for action and planning was found to be limited at all levels as it has been observed in AACGHB. Reports are primarily prepared to be sent to the higher levels and external users. For most of them, the use of the information collected every month is only for reporting and not for proper allocation of resources and planning.

ORHB has adequate resources to provide feedback to the zones; supervision, telephone communication, and written notes were mentioned by the staff as ways to provide feedback to zones. Even if there are many ways and opportunities to give feedback to lower levels health offices and health facilities, there was no evidence, which indicates that feedback is being given. Experts of the ORHB supervise lower level health offices and health facilities only once in a year. They visit selected zones, weredas, health facilities, and project sites using pre-designed checklists. The experts give comments and share ideas to improve the health services. Unfortunately, the HMIS team was not involved in the supervisions. In December 2004, they were asked to prepare a checklist for supervision. We think this was a good opportunity for them to see what is going on at the lower levels regarding data collection and processing, and that may help to improve the HMIS.

Most informants in the region agree that there have been improvements in the quality of data collected over the last two years because the quality of reports is now one of the attributes used to measure the performance of the ZHD. Regarding this, a ORHB staff said:

> *Lately the quality of reports has improved since good reporting is considered as an attribute to evaluate the performance of zone. The overall zone evaluation paper is presented in quarterly review meetings so as to create some kind of competition among zones. Therefore the quality of data is now good (Expert, ORHB).*

In summary, the data collection, processing and reporting activity is a reflection of each organizational structure in every health level. The availability of resources also depends up on the physical location of the health facility. Obviously, the health facility or the wereda health office located in urban areas has better access to necessary resources as compared to rural health facilities or wereda health offices found in small rural towns. Having discussed issues concerning resources, how data is being collected, processed, and reported at various levels, now we discuss and analyze the identified problems.

## 5.5 Analysis of problems identified in the existing HII: across regions

This section summarizes the major problems, which cause the current HII in Addis Ababa and Oromia to be largely ineffective and inefficient to support the over all health service delivery activities. We first discuss the identified problems; and then analyse their possible causes.

- **Ambiguity of data elements in the reporting formats**

Ambiguity arises due to the overlapping of some data elements in the reporting formats. For example, in Addis Ababa region, in the IMCI reporting format, there was an overlap for the age categories '1week-2months of age' and '2 month-59month of age' (See Appendix E.1). A two month age baby falls into both categories. None of the health workers that we interviewed realized this overlap before we asked them. The IMCI reporting format is the integration of the old Acute Respiratory Infection (ARI), Childhood Diarreahal Disease (CDD) and 'Sick babies; reporting formats. These reporting formats were being used in Oromia and we were able to observe the same age overlapping over there too.

The other ambiguity arises as a result of the inconsistency between the registers and the reporting formats. For example, the registers in laboratories do not have place to register sex. In some places, they modified the layout to include this data element while others did not report the laboratory report by sex even if it was requested in the monthly reporting format. Moreover, it is difficult to register sex since the laboratory request paper, from which the laboratory registers were filled in, itself, did not identify sex. Therefore, health workers were forced to register sex based on the name of the patient. This is often misleading as some names can serve for both males and females.

- **Incompleteness and un-timeliness of data and reports**

In our case, completeness of data can be seen to be two-dimensional; 1) recording all relevant information (complete data set) and 2) receiving data from all lower levels (all facilities in a wereda and all weredas in a region).

Most of our informants from the ZHD and WerHO of the Oromia region explained the improvement in the timeliness of reporting as a result of the implementation of the government's civil servants' performance evaluation approach called 'result-oriented'. In this approach, civil servants are evaluated on their work performance by their immediate boss and action is to be taken accordingly. In the health care sector, where reporting is described as one activity of the health workers, he/she is to be evaluated based on reporting on time. This approach is also implemented to evaluate the performance at each health administration level where reporting is considered as one attribute. As a result, health workers at the wereda level felt pressured to send incomplete reports, since they did not get facility reports on time due to various reasons (such as poor infrastructure), in order to save themselves (salary deduction) and other forms of reprimand during performance evaluation.

This above problem is also illustrated by the results of the questionnaire that was distributed for 16 HMIS personnel (two from the zone and fourteen from the weredas) in Oromia. While the zone staff claimed that they received the reports on a timely basis, 11 of the 14 (69%) persons from the weredas described that they did not get reports on a timely basis (see Table 5-4). This implies that the wereda personnel are sending incomplete reports to the zone in order to meet deadlines. The zones did not have any mechanism to know how many health facilities are missing in the reports. This in turn implies that the health workers focus on the performance evaluation by ignoring the quality of data. One can note from this case that for the realization of such kind of evaluation requires appropriate organizational change (for example placing adequate infrastructures), information handling procedures and data validation techniques. Table 5-4 summarises the result of the questionnaire.

| Respondents | Do you receive monthly data on time from the lower levels? | | | |
|---|---|---|---|---|
| | Yes | | No | |
| | Number | Percentage | Number | Percentage |
| Zone(2) | 2 | 100% | - | - |
| Wereda(16) | 5 | 31.5% | 11 | 68.75% |

**Table 5-4 Timeliness of reports**

The incompleteness and un-timeliness of data increases as one goes up to the upper level. At the national level, for example, the HIPDT leader indicated that most often the national indicators are prepared based on incomplete data due to late or incomplete reporting from the RHBs. Incompleteness arises from not recording of all relevant data. It is difficult to identify this kind of incompleteness without considering data quality as an issue during supervision. For example, during the field work in Addis Ababa, we identified that the reports were received from only one out of three physicians working at the eye Outpatient Department in the overall report in one hospital. Others left blank some of the information, and filled in what they thought was enough. For example, only the first and repeat antenatal visits were reported while the form requested up to fourth and more visits. Investigating the importance of the omitted data as to their usefulness is beyond our professional capacity. But what we can see, however, is that the forms were not used appropriately. We can conclude that the data that the higher levels receive are poor in quality due to their incompleteness.

- **Inaccuracy of data**

As human beings are prone to errors, the manual aggregation of data often leads to mistakes. This can be exemplified by the analysis of data at Kirkos SHD (See Table 6-1 in next chapter) that was aggregated by the CDC team members. In this example, the data

was collected manually and was compared with that in the computer system for three months. In most cases, the data which were generated from the computer system was found to be more accurate than the manually processed one.

- **Inconsistent data collection procedures**

The inconsistent data collection procedures also contributed to the production of poor quality data. For example, in some facilities there was a practice of collecting EPI data categorized by age (ex. BCG 0-11 and BCG 12-24) and in others the same data were collected (like in BCG) with out age break ups. This work practice was a reflection of the inconsistent EPI data collection format. Some formats required data to be collected by age category and the others did not. This created discrepancy as the upper levels (zone and region) needed the data by age wise break-up. There were also inconsistent procedures for the collection of MM data which makes the creditability of the MM data questionable. Some hospital and/or wards in the hospitals use 'on admission' (when the patient is hospitalised) to register the patients information while the other use on "on discharge" (when the patient leaves the hospital). In the first case, statisticians may miss the patient's data for those who are not discharged in the month that the data collection took place. The problem is magnified when admission and discharge are used inconsistently within the same hospital. Moreover, the inconsistent data collection procedure of 'growth monitoring' data, which was done from two departments, EPI and IMCI, may lead to double counting of a child.

The use of standard ICD code to represent diseases is in theory an appropriate way to practice consistent MM data collection. On the contrary, in Ethiopia the use of an old and cumbersome list of codes was seemed to contribute to the poor quality of data. This entails not only the absence of standards, but also the lack of contextual considerations in order to make the use of standards locally appropriate.

Different factors have been identified to contribute to the above mentioned problems of data. These are; poor infrastructure, inadequate HII resources, fragmented reporting systems, poor information use culture, and weak awareness about the importance of data quality. We now discuss each of them in brief.

- **Poor infrastructure**

The absence of good road, transportation facility, and communication technology at lower levels (wereda and health facility) adversely impacts the quality of data. The fact that most of the health facilities in Oromia regions are located in rural areas in which transportation facility is poor, getting HII resources like data collection tools was observed to consume much time and cost. Accordingly, reporting was also delayed for a significant period of time, especially during the winter period, and it is necessary to wait for special days (like the market day) to get transportation facility in the summer time. This was explained by most HMIS personnel and health workers who work in rural weredas and health facilities in Oromia. However, in Addis, such kind of problems was not mentioned as causes of delayed reports.

- **Inadequate HII resources (data collection instruments, human resources and computers)**

Health facilities, especially in Oromia, did not usually get adequate data collection and reporting formats. Hence, health workers were forced to prepare the reporting formats using pen and paper. The scarcity of these data collection tools were seen to be aggravated at lower levels; at the wereda and health facilities, where duplication machines were not available, particularly in Oromia region.

The human resources availability was different in the two regions. For instance in Addis, dedicated staff were assigned to the health facilities, which was not the case in Oromia. However, at the health facility level, the educational background of most of them was

neither medical nor in statistics. Taking into account the absence of overall HMIS training, this weak educational background also has an impact on data quality. Despite the fact that there were dedicated persons for HMIS at wereda/sub-city level, they spent most of their time on other tasks such as supervision. Moreover, in some of the weredas in Oromia, the HMIS positions were covered by the clinical nurses from the nearest health center as an additional assignment. The HMIS unit was organized as a team at both the regional and national levels. However, the staffing pattern that we observed at the regional and national levels was not suitable for the production of quality information. i.e. it lacked multidisciplinary. Most of the staff at the regional and national levels were computer experts, economists, or accountants with limited or no public health inputs.

In addition to the absence of a structure for HMIS persons, those who were engaged in the information handling processes had never attended HMIS training and their job was also not well supported by the availability of user manuals, and guidelines. HMIS training was not given as a course or part of a course in the formal schooling of health. Therefore, there is a need to think about how continuous training can be organized to develop the skills of health workers as well as of managers to produce quality information and to use it for decisions. Such courses need to be incorporated in the health colleges, and requires further research. The lack of training implies that the HII activity at all levels of the health structure is being carried out in traditional ways gained through job experience and informal communication without standardised work practices and formal training.

Regarding computers, most of the rural areas do not have any computers. Even the available computers are under utilised at all levels, being used for word processing rather than for processing health data. In addition to this, some computers are not functioning because of minor technical problems, and this issue is magnified due to lack of support structures and limited capability in the facilities to sort out even minor technical problems.

- **Fragmentation of the paper-based reporting system**

The lack of horizontal coordination of the vertical health programs that are organized in the same department or in different departments was found to be the main source of the proliferation of reporting formats and the redundancy of data elements. For example, the IDSR, Sexually Transmitted Infections (STI) and HIV/AIDS reports were administered by different teams of the Disease Prevention and Control Department. In spite of being organized in the same department which should ideally imply sharing of work and activities, each team produces its own reporting formats without consulting the others. This makes the HII to be fragmented and bulky, rather than an indicator-driven system which could effectively support health management activities. Moreover, as it has been observed, the figures for the same data element differ across the reporting formats and units. For example, in Addis, for the three months (July-September), the IDSR reporting format shows 7430 pneumonia (<5yrs), 1474 typhoid fever, and 133 relapsing fever outpatient cases at the region level, while the morbidity statistics present 6534, 22, and 7 respectively for the same data elements.

- **Fragmentation of the technical system**

The monthly reports that were received from the wereda/facility were processed independently by the corresponding health programme experts at sub-city/zonal/regional level. Each health programme expert processes his/her own data using program specific applications; for example, NTCP-MIS or using general applications like MS Excel. This fragmentation contributes to wastage of scarce human and non human resources, and leads to a further fragmentation of the system. NTCP-MIS, EpiInfo, surveillance system, Prospective Malaria Data processing and MS Excel are the identified applications which are running at the regional or zonal levels. The availability of LAN in the Addis Ababa Health Bureau is under-utilised when it is seen from its potential of integrating the technically fragmented systems. Therefore, there is a need to develop an integrated HMIS that enables effective health management.

- **Weak information use culture**

The ultimate objective of a HII is not to gain 'information' but to 'improve action'. The poor data analysis and its interpretation, and the large amount of data that were being collected without considering its usefulness reflect the poor information culture in the health care system. Also, since the resource allocation to health facilities is not based on the reports that they send to upper levels, there is little incentive for the health staff to strengthen the existing HII

The collected data were mainly used to prepare monthly reports for the next level without being used at the local level. Although the decisions taken at the wereda/sub-city level are crucial to deliver proper health services to the community, they were not usually made based on information; but rather based on the available budget, informal communication, and from past experience. Staff at the RHBs said they were using the quarterly, semi-annual and annual performance report for planning. However, these reports contained various tables of aggregated data that could not give meaningful information to support such planning activities (See IDSR report in Appendix E-8).

This poor information-use culture at all levels has negative implications for data quality since no one cares to collect and transmit it. Therefore, a need to develop a strong information use culture is identified as being important to strengthen the existing system.

To sum up, the above discussion which is drawn from the current HII situation study of Addis Ababa and Oromia regions identifies problems that also more broadly reflect the situation of the Ethiopian HII. As a result, the HII is largely incapable to provide appropriate quality information for management and decision making at all levels. This study also shows that most of the problems are related to the wider context of the HII, such as infrastructure (poor roads), human resources, culture and work practices of the people and the organizational structure (vertically organized disease specific health

programmes). These contextual conditions need to be addressed in order to improve the existing HII and move it from being data-driven to action-driven. Such a focus is a key objective of the HISP initiative, which specifically seeks to address the following issues:

- set a minimum regional data set;
- standardize data collecting instruments, software systems and work practices
- introduce a computerized HII at the district level; and,
- engage in capacity building efforts so as to strengthen the information use culture

In the next chapter we discuss the action interventions with respect to the HII improvement that were carried out in Addis Ababa and Oromia regions.

# 6 ACTION RESEARCH INTERVENTIONS

## 6.1 Introduction

This chapter provides narrative descriptions of DHIS development and implementation processes for the two regions; Addis Ababa and Oromia respectively. The processes represent the action taking and evaluating phases in the action research cycle to improve the weaknesses of the existing HII identified during the situation analysis; the diagnosis phase. The intervention processes include; standardizing, local adaptation, training and scaling. After we summarise the outcomes of the action taking phase, an evaluation will be presented to observe the changes brought by the action taking phase. Reflection as to what should be done in the next action research iteration will also be presented at the end of each region's action research intervention discussion. We discuss each of the processes briefly under each region. Unlike the case study part of the research, the action research intervention was conducted in a team comprising a PhD student and the authors.

The chapter is divided into three broad sections. Section 6.1 introduces the structure and contents of this chapter. In section, 6.2 we present the action taking phase, the outcomes and the evaluation in Addis Ababa region. In section 6.3, the same issues will be elaborated for Oromia region.

## 6.2 Addis Ababa region

As it has been explained in the previous chapters, the HII development and implementation was started in Addis Ababa and scaled up to other regions after a relatively successful implementation in this region. At the time this research was conducted, DHIS was implemented in all SHDs and five hospitals, and as of July 2005, the SHDs have started sending their reports electronically to the Plan and Program

Department of RHB. Now, we will discuss the specific efforts to improve the existing system.

- **Standardizing**

As discussed in the situation analysis, the existing HII was not efficient and needed significant improvements. Accordingly, the first activity concerned standardising the data, the collection instruments, and the software that was identified as being inconsistent and fragmented.

The main aim of the standardizing process was a) developing a minimum essential regional data set; and, b) developing uniform primary and secondary data collection instruments and c) developing standard data collecting and reporting procedures; and d) standardizing the software to reflect local needs.

The first objective was 'addressed' by producing 1202 data elements excluding the MM data. In addition, the 150 list of diseases for MM reports, categorised by age and sex, produced more than 3609 data elements made the regional data set very cumbersome. The process was followed by the process of indicator definition. In the data base, a total of fifty eight indicators were defined. Among these, fourteen were identified as national, while the others as regional. From the total of 1202 data elements, we identified only 414 were being used to produce indicators. In this study, it was not possible to investigate for what purpose each data item were being collected, and this requires further analysis. However, we were able to see that not all of the collected data items were useful. For example, for the EPI activity, each data element was presented to be collected for static and outreach. As it was explained by the EPI expert at the regional level, what was important for them was to know the number of out reach and static sites only. This was also reflected in the 1$^{st}$ quarter (July-September) EPI report of the region (See Appendix E.2).

The standardizing process also seemed to give room for additional data collection. For example, data on Tetanus vaccination used to be collected for TT1 and TT2+ (TT2 and above) only. After the standardizing process, TT2, TT3, TT4 and TT5 were added for which no good explanation could be found as to their usage (see both formats in Appendix E.4). Here, it is to be noted that all the data elements were added based on the interests and opinions of users at all levels. The above investigation shows that this standardizing process is a first small scale change process on the data collection instrument that needs to followed by subsequent improvements to help move from "maximum" to "minimum" to "essential" data sets where data items collected are analyzed with respect to how they contribute to calculation of indicators and action.

Moreover, in the relatively centralised system of the Ethiopian HII, it was not possible to change everything that seemed appropriate for improving the current system locally, without the involvement of the national level. For example, most of the data that have been collected by the IDSR and IMCI reporting formats were also collected by the MM reporting format. However, it was not possible to touch these reporting formats without consulting the respective vertical program managers at the national level. Furthermore, it was also not possible to correct the age overlap of the IMCI reporting format, which was discussed in the case descriptions, as it was introduced by the nationally based IMCI program. The repetition of data elements is seen to be the main reason for having a large number of data elements. Our process of standardizing helped to identify and make visible to the health managers these duplications.

On the other hand, the standardisation process has decreased the number of data elements by eliminating some unimportant items. For example, EPI data used to be collected by age categories (0 to 11 and 12 to 23). The current format collects data without age division which was not seen to be valuable for the action and planning beyond increasing the workload of the health workers. More importantly, uniform and comprehensive secondary data collection tools have been produced as a result of the standardizing process. Primary data collection instruments have also been designed. However, during

the fieldwork, we could observe that the newly designed primary data collection formats were not distributed to health facilities because of organisational constraints; for example the absence of a responsible person to perform the task. The current study also showed that the new data collection format design activities to address all the lower level data collection formats; such as request forms (e.g. the laboratory request form) and patient cards as they feed data to the registers and reporting formats. This can be taken as a lesson for further HISP implementation as it was not considered in this initial work.

Furthermore, the HISP interventions coincided with the creation of a new structure for the city administration (e.g. dividing the city into sub-cities and eliminating the zone level), and this has helped to update the naming system in the reporting formats which reflected the old structure.

Despite the cumbersomeness of the current data set, the users still insisted to collect more rather than less data. For example, during the field work visits, the workers at the health facility and sub-city levels were asked if the newly introduced formats enabled them to collect all the data that they needed. One of the laboratory technicians at the health facility said:

> *More items should be added. For example, ESR, WBC, D/F, Blood group, Hemoglobin should be included in the laboratory reporting format. It is not enough to summaries all these as 'others'. These are helpful for me to request reagents (Laboratory Technician, November, 2004)*

This shows that the health workers needed to report all things that are done in their organization to justify and make visible their work to the higher level. Accordingly, the statisticians at the health facilities were adding figures by pen/pencil at the bottom or top of the page for items that they needed, but these were not included in the reporting format. For example, the medical check up services for license and employment did not have a place in the reporting format. Therefore, the statisticians were adding them at the top of the out patient MM statistics monthly reporting format, though not requested by the higher levels. This implies how the real needs of the data were compromised with the

mere interest of the lower level showing that the 'work is being done' for the bosses during the form design process.

Due to the limited time that the HISP members had and the complexity of changing every thing radically, all procedural related problems have remained largely unchanged. However, we argue that unless the inconsistent work procedures are standardised, the effort of improving the existing system is ineffectual. Moreover, changing work procedure has been argued by various researchers to imply changing the behaviour of people that has existed historically, and is difficult to do because human beings are fundamentally resistant for change. Therefore, such change processes need to be cultivated through on going training and incentive activities. Broadly, our standardizing work emphasizes the impossibility of accomplishing all the phases in the action research life cycle. This means in the action taking phase; some tasks takes much more time than others. For example, standardising work procedures.

- **Local adaptation**

Having a revised version of the reporting format, the next step was to design an appropriate technology which could facilitate the data generation process. The system was designed using as a starting point the software (DHIS) developed for the South African health care system. The fact that the health care sectors share some common elements helped the work to be started in Ethiopia not from scratch. However, despite these similarities, there were also other contextual differences that needed to be addressed in the local adaptation process to enable the use of the software for the Ethiopian health care system.

The first and foremost contextual difference between the two countries was the use of the ICD code list in the Ethiopian health care system. This major local additional requirement was addressed, through designing the MM module and integrating it at the bottom of the already existed MD module of the DHIS. In the first DHIS-Ethiopia design, the data

elements were listed, making the user interface in this case very poor, i.e. a very long list of elements. This was solved by programming a new user interface for entering ICD data, where the boxes for entering data appeared as rows from a drop down list where you select the ICD code and then got all age groups and male/female break ups. The following figure shows the current user interface of the MM module.

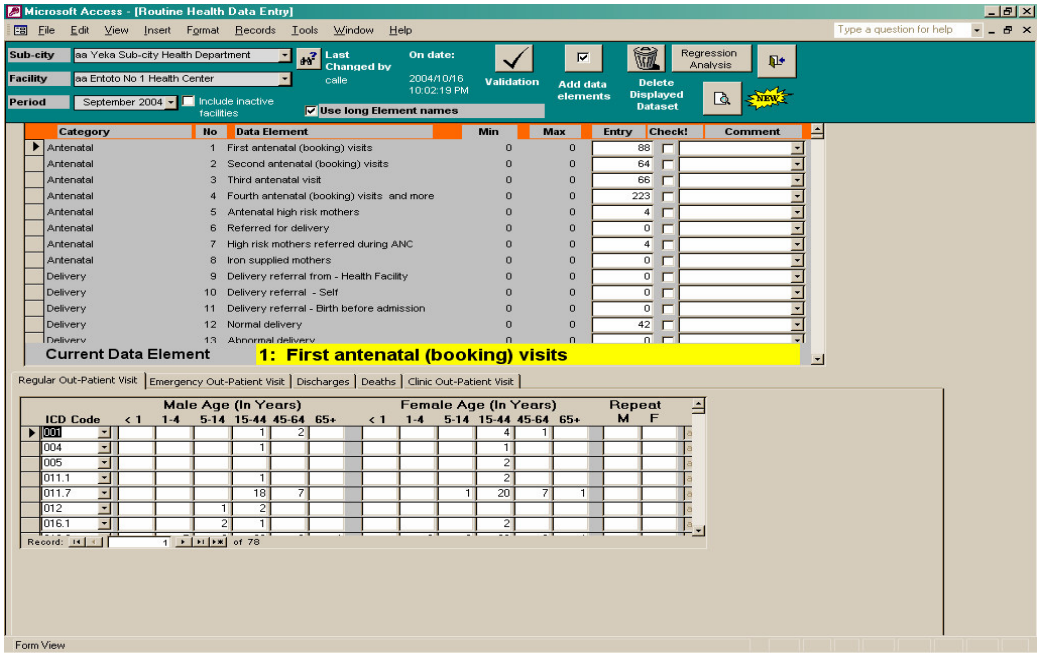



**Figure 6-1 User interface of the adapted DHIS**

The organizational structure was also adapted to accommodate the four level organizational hierarchy of the Addis structure to fit with the five level organizational structure of the DHIS software from South Africa. The data elements identified during the standardizing process were defined in a way to match with what is collected on paper. We then designed standard reports which look like the manual monthly reporting formats. After giving two operational modules of the system (Access MD and RG), the prototype was tested during the training session before the actual installation.

Ensuring that these two modules (Access MD and RG) work properly, the RHB requested to have a system which handles the TB data. Accordingly, we adapted the TB module to fit the Ethiopian year which is seven years behind to that of the Gregorian. Moreover, what is 1st quarter in Ethiopia is the 3rd quarter in South Africa. Therefore, there was a need to adjust these issues and also the data elements to use the TB module in the Ethiopian context. Therefore, the operational modules of DHIS were increased by three; Access MD, Access RG and Access TB. And as more requirements were being highlighted by users with increased level of use, the complexity of the system is also enhanced. For example, they have asked to have a personnel and pharmaceutical data base for handling their staff and drug details respectively. Due to the limited time that the researchers had, these requests have not been yet addressed, but are expected to be done in the next phase of the research.

- **Training**

The first training, for the statisticians of the SHDs and RHB, was conducted in June 2004. The training went on for two weeks in the Library of the RHB. The first week was dedicated for the basic computer course and the second week for the software course. In both, trainees were encouraged to give feedback on the system. Accordingly, technical errors on the reports and the data elements were identified and corrected. Considering the high staff turnover rate, two participants from each sub-city attended the training: the statistician and a member of either the CDC or Health services team were included in the training. However, many of the trainees did not have the opportunity to work on the system after the training, making them unable to practice what they learnt. Also, in some cases the statistician post was vacant, and a replacement could not be found.

As part of this study, the statisticians were asked to evaluate the training. All of them evaluated the course to be 'very nice' but indicated the time was very short to learn what was given in the course. At first, the DHIS manual which was prepared for the South African health care system was distributed to the health workers to support their future

work. However, they requested a simplified manual with examples from the Addis Ababa health structure. The HISP team modified the manual and distributed it for each statistician together with the system installation

Immediately after the training, the installation of the software in the ten SHDs and in the statistician office of the RHB was carried out. The immediate action of installing the software after the training helped to enable the statisticians to practice what they had learnt before they forgot it. Most of the statisticians did not have a computer at their office at the time of the system installation. Immediate action was taken by the RHB and the SHD managers to equip them with the necessary infrastructure by distributing some computers, and in some places shifting computers from other departments. In two of the SHDs, installation was made in the office of the manager. In these places, the statisticians complained about the unavailability of computers in their office, and how that was hampering their timely reporting and use of the system. They argued that this made them forget some parts of the DHIS course such as the process of data analysis. For example, one of them said:

> *I'm not comfortable to sit for a long period of time in the head office. I go there once a month to enter the data and make my monthly report. Hence, I forgot the other part of the course except data entry and exportation (Health Information worker at SHD, Nov, 2004)*

In a written feedback, another one emphasised the lack of computer, the additional responsibilities and the insufficient salary as demotivating conditions for him to work for the position he had.

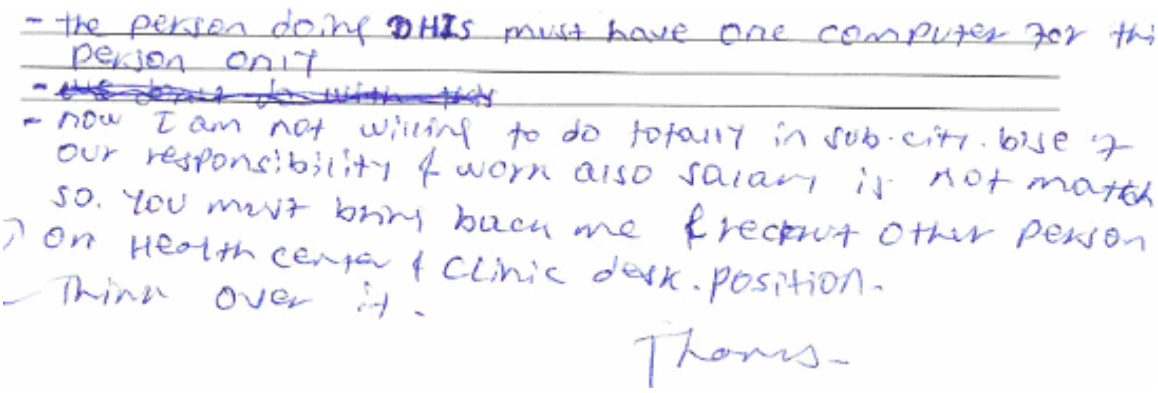



**Figure 6-2 Extracted from a written feedback made by one of the statisticians at the sub-city level**

- **Scaling up the system**

The importance of the DHIS software for improving the HII was better understood by the RHB of Addis Ababa and the SHDs as compared to Oromia, as they could observe the practical advantages in the existing SHDs' installations. Their increasing expectations thus implicitly placed pressure on us to scale up the software to the 23 health centres and 5 hospitals.

In September 2004, we conducted the second phase of the training that was organized for about 40 statisticians from the health facilities. Most of the health workers did not have basic computer skills and nor did they have a computer in their facility. As it was subsequently comprehended by us from the evaluation of the sub-city statisticians, the two weeks (10 working days) training course was inadequate, and we later considered its expansion to three weeks (or 15 working days). This also went in line with their more limited educational background and previous computer skills of this batch of trainees as compared to that of the statisticians at the sub-city level. The first week was dedicated to basic computer skills training and the remaining two weeks on how to use the DHIS software. The training was given in the computer lab of Informatics department in Addis Ababa University where HISP Ethiopia is hosted. The following photo shows the

statisticians of the 23 health centres and the five hospitals attending the DHIS training session.

**Photo 6-1 DHIS training for the Addis Ababa health facility statisticians**

**(Addis Ababa University, Sept, 2004)**

At the time of writing this thesis, there were seven computer installations in the health centres and the rest did not have computers. In the places where there was no computer, the statisticians seemed to forget what they had learnt in the training. For example, in one of the health centres, the statistician was not able to enter data in the DHIS in December when the facility received a new computer. He needed further on the job training. HISP has employed a full time support staff to facilitate such kind of training and support, who can also help to provide the users with a sense of comfort. This is something that was learnt from the failure story of the patient record system described in chapter 5. In this story, the health workers at the hospitals indicated the absence of contact person as a major reason to stop working on the system.

Both the training sessions (the first and second phases) were not accompanied by training on the data collection procedures of the newly introduced reporting formats, or the analysis of the information generated through the forms, and also on the calculation of indicators etc. In general, in our opinion, the course was dominated by software issues rather than on the creation of an information use culture which we identified as a key problem in the region. This is by no means to say that there was no effort in this direction, but it is to emphasize its relative insufficient focus with respect to the significance of the problem. This might be the result of the team composition which was dominated by informatics people and has limited public health inputs. We need to work in the future towards redressing this imbalance.

- **Outcomes of the action taking**

In chapter (5), we discussed the findings of the situation analysis; which represent the diagnosis phase of the action research cycle. In that phase, we were able to identify the problems and strengths of the existing HII. In the proceeding sections of this chapter, we discussed the actions which were taken to improve the weaknesses; standardizing, training, local adaptation and scaling up of the system. These interventions have led to some observable changes in the HII. For example, the previous un-standard data collection formats have been changed, users have been trained on basic computer skills and data processing and reporting are now to a certain extent being done electronically. In this section, we will specifically describe two sets of observable changes and in one area (work practices) where we could not effectively introduce change:

1. With respect to the information flow
2. With respect to the data quality and
3. With respect to the work practices of the health staff.

In the following section, we reflect on each of these changes and how they can be iteratively strengthened in the future.

### 1. The information flow: redefinition

The DHIS has formed one comprehensive channel of information flow through the statistician at the sub-city level as illustrated in Figure 6-3. Ideally, this is the information flow which was expected to exist in the health structure of the region. However, as an existing work practice, the various health programs that are found in the region acquired the reports, on their information needs, directly from the SHDs. In this case, the statistician, at the regional level, became responsible only for the MM data collecting and reporting activities and that there was no place to find comprehensive health data. In reflecting, the work practices of the upper level, there was also limited practices supporting comprehensive data collecting and reporting at the SHD. As we have discussed in the earlier section, the statistician at this level too was responsible for only MM data.

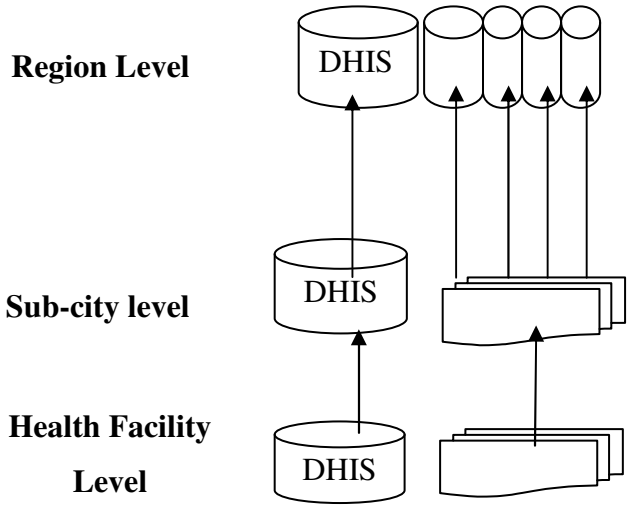



**Figure 6-3 Redefining the information flow**

**(Source: Fieldwork in Addis Ababa region, End of January 2oo4)**

Therefore, together with the data set and reporting formats standardizing processes, there was also a need to redefine and standardise the information flow. The current flow of information in the region is depicted in the figure above. Even if the figure does not represent, the usual way of aggregating health posts' data together with that of health

centres, it has also changed in a way to reach the sub-city level for data entry (where there is no computer at the facility).

While this the DHIS has contributed to the creation of one comprehensive reporting system, the non aligned interests of the health programs at the RHB makes the implementation of the software to contribute to the formation of parallel reporting systems (paper and computer based). The separation starts at the sub-city level. The first flow, which goes through the statistician, uses the DHIS as an information processing tool and the data is reported electronically. Accordingly, the statistician at the Plan and Program Department is getting all types of reports in addition to the MM data and diagnostic tests, which were the only data that the department was receiving before the implementation of the new system. However, the other departments, Family Health (which constitutes Maternal and Adolescent Reproductive Health, Child Health, EPI and Family Planning experts) and Disease Prevention and Control (TB, Leprosy & HIV/AIDS and Surveillance experts) keeps the status quo of the reports going directly from the CDC team of the SHD. They aggregate the sub-city data to get the monthly report by region and send it to the respective health programs at the national level. They use different computer systems for data processing activities. Hence, the fragmentation of the information flow (illustrated in Figure 5-3) has continued in the manual system while all data elements gained form the data set standardizing process are represented in the DHIS.

The above discussion helps to emphasise the unintended consequences of the DHIS implementation which has contributed to create double data processing and reporting at the sub-city and regional levels. Initially, the intention was to make the statistician serve as the data repository and disseminate any information to each department based on their information needs. As the double data processing and reporting wastes the limited human resources that exist in the region, there is a need to work on integrating the paper and computer-based information flows in the future.

## 2. Data quality: some improvements

We observed some improvement on the data quality after the implementation of the DHIS. To perform this, we used a quarterly report (July-September 2004) of Kirkos SHD. We got the DHIS generated reports from the statistician and the manually generated reports from the CDC team. The comparison shows that aggregation errors in the paper-based system, such as when the program experts sum up the totals and compiles the facilities data to produce the overall sub-city data manually. For example, Table 6-1 shows the difference between the CDC and DHIS reports of the monthly IMCI report by sub-city. In each case, the DHIS report appeared to be correct when it was cross checked from what the health facilities reports showed.

| Month | Data element | Data source | |
|---|---|---|---|
| | | CDC | DHIS |
| September | Total nutritional problem initial(grand total) | 1308 | 1330 |
| | Others initial (Grand total) | 519 | 499 |
| August | Total Nutritional problem referred(grand total) | 191 | 6 |
| | No feeding problem referred(grand total) | 0 | 187 |
| July | Total children seen initial(1w-2m) | 53 | 66 |
| | Total measles initial(2m-59m) | 164 | 0 |

**Table 6-1 Comparison of DHIS and CDC report for IMCI data**

The differences can be associated to the informal data flow between the CDC team and statistician and the late received private clinics reports. There is no clear procedure for who should first receive the health facility data. The one that gets the report first, transfers to the other after doing his/her own processing. As a result, it is likely that one may forget reports at the office with out transferring to the other. In one of the sub-cities,

the statistician told us that she always goes to search for forgotten reports in the CDC team experts' office. Moreover, when the private clinics bring reports after the deadline, the CDC team does not report it as it is difficult to make aggregation manually once it is done. Therefore, they will report it together with the next month's data. The statistician makes the report on the spot as they are not required to manually sum up, and only do the data entry in DHIS and leave the calculation to the software.

### 3. Work practices: the inertia of change

All the issues discussed above reflect the work practices that affect the quality of the data adversely, but have not been adequately recognized and addressed by the RHB and the HISP team before the introduction of the new system. For the time being, as the implementation is in its early stage, and having both reporting systems (paper-based and computerised) seems appropriate to identify and clarify some of the technical errors which are being reported by the health workers. However, there needs to be an increase in effort in working with the health program experts as well to change their current attitudes towards the system and to bring about better management support HII.

The experts in CDC team were asked as to why they were processing data separately instead of using the processed one from the statistician. The MCH expert replied as follows:

> *Even if the data collection and aggregation is additional and the most time taking work for us, we are forced to do so from the RHB even though they know that double processing of data is being done. I want to use what is processed by the statistician to make our work easier (MCH expert, November, 2004)*

Even if the lower levels were interested to work on the DHIS to lessen their workload, the health program experts at the regional level resisted to change their usual work practices. They pointed out their doubts about the credibility of the DHIS generated reports as a justification to resist changing their work practices. They inferred this from the extreme figure differences that were observed between the two systems reports. Of course, we

also share their view with regard to the figure differences. For example, the following table shows the figure difference between CDC and DHIS reports for health education data. For instance, for IMCI related education, the CDC report shows 2130 females attendants while the DHIS report shows 1653.

| Subject | Data Source | July | | September | | August | |
|---|---|---|---|---|---|---|---|
| | | Male | Male | Female | Female | Male | Female |
| IMCI related | CDC | 1118 | 645 | 2130 | 1653 | 512 | 1754 |
| | DHIS | 998 | 620 | 1163 | 1308 | 612 | 1559 |
| EPI | CDC | 760 | 270 | 755 | 1039 | 810 | 1127 |
| | DHIS | 700 | 267 | 737 | 874 | 366 | 527 |
| Antenatal/PMTCT | CDC | 359 | 647 | 1882 | 663 | 283 | 867 |
| | DHIS | 234 | 329 | 1009 | 563 | 283 | 667 |
| Post natal | CDC | 365 | 288 | 288 | 783 | 118 | 276 |
| | DHIS | 359 | 261 | 278 | 783 | 118 | 178 |
| Family Planning | CDC | 490 | 219 | 833 | 1122 | 705 | 1257 |
| | DHIS | 400 | 219 | 793 | 876 | 197 | 763 |
| Post abortion | CDC | 194 | 244 | 269 | 265 | 122 | 284 |
| | DHIS | 194 | 244 | 269 | 265 | 122 | 122 |
| Adolescent Reproductive health | CDC | 517 | 890 | 1105 | 697 | 600 | 743 |
| | DHIS | 467 | 890 | 1105 | 697 | 600 | 643 |
| HIV/AIDS & STD | CDC | 1970 | 1435 | 2894 | 2306 | 993 | 2147 |
| | DHIS | 970 | 1425 | 1952 | 1301 | 907 | 1253 |
| TB and Leprosy | CDC | 755 | 737 | 666 | 758 | 523 | 692 |
| | DHIS | 755 | 734 | 626 | 758 | 524 | 371 |
| Environmental Sanitation | CDC | 819 | 128 | 676 | 819 | 427 | 608 |
| | DHIS | 819 | 126 | 636 | 819 | 328 | 505 |
| Other | CDC | 1023 | 1516 | 1904 | 1226 | 1579 | 1832 |
| | DHIS | 1053 | 1516 | 1904 | 1226 | 1798 | 1835 |

**Table 6-2 Comparison of DHIS and CDC sub-city level data**

These differences were mainly caused by the reports from the hospitals. In principle, the five hospitals are reporting to the region directly. However, as described in the current

HII situation study, some reports like EPI, health education and health learning material are being reported to the SHD in addition. These reports are not entered in the DHIS. DHIS recognizes the regional hospitals at a level similar to the SHDs. Therefore, the statisticians were not allowed to enter data for the hospitals. This creates a discrepancy between the figures reported by the two systems. In addition, the data accuracy problem that we observed and discussed above also contributes to the differences in the figures. These existing work practices were not recognised by the health program experts and became a source of inertia for change which adversely affected the overall HII improvement processes.

- **Evaluating the outcomes**

After the actions were completed, we undertook an evaluation of the outcomes after six months of the system installation. The aim of the evaluation was to know whether the outcomes of the research has helped to relieve the problems and attained its objectives of contributing to improving the existing HII. The action research can be regarded as being successful in a way that the standardised data collection formats and the use of computers for data processing and reporting have arguably contributed to the improvement of the HII. The health workers have also praised the actions taken to relieve some of the problems of the existing HII. For example, one of the sub-city managers said the following:

> *It was difficult to get information whenever we want once it is reported. Now, we can get whatever we want and at any time. This is the great advantage that I observed with in this short period of time (Sub-city manager, January 2004)*

We also acknowledge, the action taking phase has not improved the system entirely and there is a long road to travel in the future. For example, we believe that in the subsequent cycles of the action research cycle, the following points need to be addressed to improve the system.

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- Shifting from the current maximum data set to minimum and essential data set: Due to the lack of the national level involvement where most of the reporting formats are generated, it was not possible to reduce the data elements that were redundant. The next action research iteration should emphasise on the involvement of this level and on reducing the data set.
- Making data for action and planning: Data were still not being used for action, but primarily for reporting purposes. The previous attitude and work structures of 'data for reporting' attitude could not be changed These changes involve the redefinition of historically embedded social structures and ways of working which entails prolonged educational and training processes that transcend what is emphasized by software courses.
- Standardising the primary data collecting format: Even though it was possible to enable the use of uniform primary data collection formats, the secondary sources of data could not be changed. For example, the format and availability of registers. This issue needs urgent attention as it is very important for the over all improvement of the system.
- Standardising the work procedures including the data flow: Standardising the work procedures remains unchanged and is influencing the data quality. This needs, as our experience shows, a relatively longer period of time and could not be achieved in this action research iteration. For example, it was not possible to create one comprehensive channel for the information flow due to various reasons including the inertia in the attitudes of the health program experts and also the historically existing vertical program structure – donor funding etc. This needs a capacity to negotiate and align their interests into the overall interest of HISP and the Plan and Program Department of the RHB.
- Addressing the evolving information need of the regions: Many of the functional requirements of the users were not fully addressed; such as personnel data base. Also, since new requirements evolve with use, the action research becomes an ongoing process.

Therefore, there is a need to accomplish the above tasks in the next iteration of the action research cycle for making further improvements in the HII. These tasks are related to standardizing (moving towards the definition of essential data set and standardizing the work procedures in line with the redefined datasets) and scaling up (horizontally to include the health programs, vertically to include the national level, and functionally to incorporate new requirements; such as the personnel data base). These issues are further discussed in the next chapter, where we reflect to future strategies. In the next section we will present the action research intervention that was conducted in Oromia region.

## 6.3 Oromia region

The implementation processes started in Addis Ababa in January 2004, when negotiations to introduce HISP in Oromia were in the pipeline. From January to July 2004, a number of important measures were taken in Addis Ababa including the standardizing of the set data, design of uniform data collection instruments, software adaptation, and field implementation in selected sub-cities. As a result, by the time HISP received approval to implement DHIS in Oromia in July 2004, there was a lot of experience and products (for example, sets of data and software) that could be taken as the point of departure for Oromia. This, as we will subsequently analyze, had direct implications for the processes of scaling and standardizing.

The HISP team formally introduced its objectives to the ORHB in July 2003. The bureau was interested and by writing a letter of cooperation to the team it allowed the project to be implemented. The initial assessment of the situation (presented in the previous chapter) was started in July 2003 (during our winter break in the Masters studies) in two weredas namely Adaa Liben and Adama WerHO and its nearest health facilities. The initial assessment included the collection of various data collection and reporting formats, interviewing key persons to understand the flow of data collection, processing, summarizing and reporting health information.

A PhD. candidate held a series of decisions with concerned departments for about six months from January 2004 – July 2004 to begin the implementation. On July 27, 2004, the ORHB head organized an important meeting in which we participated along with the planning department head and some experts of the bureau. We described the functionalities of DHIS, and the need for standardizing data sets and organizing training etc. At the end of the meeting, the following four-point resolution was passed to start the action research interventions; 1) East Shoa zone was selected as the pilot site; 2) Planning department will make the implementation of the project as one of its main activities; 3) Organizing training for the pilot sites; and, 4) To establish a Task Force to finalize the standardizing of reporting formats. However, this agreement was not formalized in written form by specifying each party's activities. Out of these 4 decisions, the first three have been carried out according to the plan, and the standardizing process is still going on. As the action research interventions in Addis Ababa is described under six headings (standardizing, local adaptation, training, and scaling, the outcome of the action to be taken and evaluation of the system), we use the same structure to describe the processes in Oromia.

- **Standardizing**

We can say that the standardisation work in this region was relatively smooth, since we had gained a great degree of experience and feedback from the work in Addis. As a result, we did not have to reinvent the wheel and not repeat the same mistakes. Taking the Addis data set and reporting formats as a point of departure, in cooperation with staff of the Planning and MCH department, we prepared the initial data collections formats for Oromia. We then distributed them to all departments to obtain their feedback**.**

Furthermore, two group discussions were held on these initially designed data collection formats. The first one was held in Nazreth Malaria training Center during the DHIS training session which was organised by HISP to the HMIS personnel of East Shoa zone and its weredas. The other discussion forum was organized by Essential Service for

Health in Ethiopia (ESHE) and ORHB on August 27, 2004. This was a half-day workshop. Even if the main objective was not to discuss standardizing, we took the advantage of people being there to discuss on the regional data set since the workshop had a general objective of improving the existing HII.

During these discussions, we distributed the prepared forms to all trainees and the participants of the meetings and requested for their feedback. The workshop participants were divided into five groups to facilitate the discussion: Maternal Health, Child Health, Human Resource, Malaria and TB, Leprosy and HIV/AIDS (the three were discussed in one group). Each group discussed one particular health programme and presented its conclusions. Both the participants and trainees suggested the need to include data element categories; such as CDD, ARI, Malaria, and also specific data elements that were part of the existing HII. Most of their suggestions were to include every activity carried out in the health services without weighing their importance. Discussions followed the presentations, where comments, suggestions and ideas on standardizing issues were forwarded. One participant commented:

> *The data should be divided according to the need of each health hierarchies (wereda, zone and region). Other wise the same mess will be created. (Currently) all collected information is being sent to higher levels with out considering whether it is relevant to the activities of that office or not. …That is why the current data and reports are bulky (Participant, Adama workshop, August 2004).*

Another participant from ESHE also expressed his opinion as follows:

> *I heard from all the group presentations that we need to add more data elements in each program rather than to reduce the existing irrelevant data element… We have to concentrate more on the collection of relevant data which leads us to make the right decision,… so let us also consider this idea (ESHE representative, Adama workshop, August 2004).*

Although some important comments and issues were raised to remove irrelevant data elements and also include some other relevant data, these were not put to practice due to three major reasons. First as it has been in the case of Addis Ababa, those who first designed most of the existing data collection forms, the MOH, did not attend the

workshop. Second, the participants were not informed about the standardizing agenda before coming to the training workshop. Third, the time allocated was inadequate (only half day) for both introducing the new data collection forms and to get the participants' comments on them.

Furthermore, although the organizers, at the conclusion of the workshop, promised to organize another forum allocating more time and inviting more participants, it did not materialize until January 2004. The ORHB presented various reasons not to finalize the standardizing activity in their discussion at different forums. For example, the planning department head discussed the delay in the standardizing process as follows:

> *Standardizing is not as such a simple work that we can do together with a small group of people. It needs more time We also need to coordinate the zones and organize a workshop that requires time, budget and human resource. The department is understaffed… as you know the team leader submitted a letter asking for release and the current staff are new. Any way, we will be focusing more on standardizing in the next three month (Department head, ORHB, December 2004).*

In spite of the practical problems, there was a need to work intensively to bring about the desired change gradually. We have revised and incorporated new requirements based on the comments and suggestions given by RHBs and the pilot zone staff. After that, HISP and the Planning service of ORHB have agreed to use the revised data collection form for the pilot sites since the staff of the pilot site had participated in the revision process. However, the distribution of the new data collection form was delayed due to various logistics problems; for example, the availability of paper. In December 2004, the revised and comprehensive data collection formats were distributed to the pilot zone by the RHB.

The data collection formats were still too many. And they were developed not based on the criteria of relevance but by rather sorting out the existing data collection formats and removing some duplicate ones, and by putting all data elements into one. Similar to the case in Addis Ababa, what was produced here could also be described as a minimum

common data set rather than an essential data set. The following photos show workshop participants discussing while formulating the regional data set.

**Photo 6-2 A group discussion on standardizing in a half day workshop**

**(Adama Ras Hotel, Nazreth, Aug27, 2004)**

- **Local adaptation**

We adapted the DHIS software to the local context of Oromia based on the already adapted software from Addis. The work did not require a great effort as compared to the initial efforts required in the adaptation process in Addis. The major difference between the Addis Ababa and Oromia Regions was that while Addis Ababa has four hierarchical levels (Health Facility, Sub-city, Region, National), Oromia, because of its large size, has five levels (Health Facility, Wereda, Zone, Region, National). This structural difference required the addition of one structural level in the database. In addition to the organizational structure change, some data element categories; such as CDD, ARI and 'environmental health' needed to be introduced in the Oromia data base. The organizational units have also been changed to fit with the structure of Oromia (i.e. health facilities, wereda health offices, Zonal health departments and RHBs)

Sample data from all types of health facilities in the pilot site were entered in the software for prototyping prior to the real installation. The testing and verification of the prototype

included all processes of the DHIS such as data entry, exporting to data mart and disk, importing data to the database and generating reports. In general, the development of the first version of the prototype took place for three weeks; from July 28 – August 16 2004. The prototype developed was used to provide training and it was also installed in the pilot sites immediately after conducting the training. Suggestions, comments and new requirements were gathered from the trainees during the training period and after. Users, thus, got an opportunity to provide their requirements and to participate in designing the new system. Three major comments that required us to modify the database were:

> *Our wereda is currently divided into two as rural and urban Shashemene. I am from urban. Therefore health facilities should be divided. All of the health posts belong to rural part of the wereda and the health center and some clinics belong to the urban part.*

The new structural changes made by the government regarding the wereda administration forced us to change the initially designed database. The second comment was regarding the MM data entry interface:

> *Entering the health center and hospital morbidity and mortality data is time taking. If I want to load information on a disease for different age and sex category, I have to select the disease code repeatedly. In this way it does not facilitate the work rather it makes it more difficult.*

Complaints from participants about the inconvenience of data entry in the MM data module was accepted by us during the training session, and served as a major input to redesign the interface. The other comment was to incorporate data entry interface for handling the forty eight common diseases. A participant said:

> *There are forty eight identified common diseases which are reported from the health post and clinic, how can we manage that I haven't seen anything in the database.*

The common diseases' data had no place in the initially designed database. The common diseases data are collected from health posts and clinics and are the simplified lists of the MM data. Instead of the ICD number, a sequential number (1-48) is used to identify these diseases. To make the software acceptable in this region, there was a need to incorporate

a list of common diseases to the already existing MM module. The following figure shows the interface for the data loading of the common diseases.

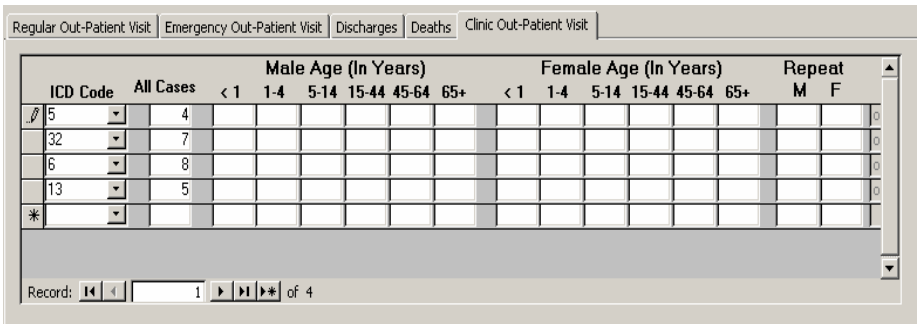


**Figure 6-4 Common diseases data entry screen**

After the verification and testing by entering sample data randomly, we handed over the software to the facilitator to further test the system, including the data entry and report generation functionalities. Various instances of missed and misplaced data elements both in the report and data entry form, naming problems, formula errors were identified and corrected during the verification and testing process. Misplaced data elements errors were common because often data element names were quite similar which made it difficult to identify. For example "P/V done out patients 1-4 year" and "P/F done out patients 1-4 year".

Within a one month period (September 1 – October 3, 2004), all the user requirements were addressed in the system and the identified errors were corrected. Finally, the software was installed on the computers found in the ORHB, ZHD and six WerHOs in October 2004 and in two other WerHOs in November 2004.

Data entry was also carried out during the installation period to see the practical problems. Some missed data elements were also made visible that required minor modifications. It was a good opportunity for us to see the practical problems and try to solve them on the spot. The re-customization of the database as per the inputs received from the second DHIS training session could not be completed due to time constraints.

- **Training**

From the experience of Addis Ababa, we realized the need for more training and support and hired in September 2004 a person who has a diploma in computer science, to provide full time support. We assigned him to provide technical support exclusively for Oromia region. His key responsibilities were to provide on the job support to users, to conduct system maintenance, and to provide training when needed. However, the level of training and support has been impeded by shortage of transportation. The shortage of transportation is serious in Oromia as it is a vast region. This issue was raised in the quarterly zonal meeting in January 21, 2004; and the zonal head then promised to provide the support needed. The support staff was initially residing at the pilot zone health office in order to be near to the other weredas. However, in December 2004, adjustment was made so that the support staff would spend also some time in the RHB to help build the staff capacity there.

Having settled the support staff issue, HISP submitted a short training proposal to theRHB; which included the course type and its duration, number of trainees, and resources for the first training (see Appendix C). Discussion was also held based on the proposal. Concerning the training the department head said:

> *It is difficult to train two staff from wereda at once, because the number of staff at wereda level is mostly two…In addition to that the wereda heads will have a meeting with in this schedule. So it is better to discuss the wereda heads case in future and let us start the training with HMIS persons for the time being (Department Head, ORHB, August 2004).*

HISP did not have the mandate to select trainees, and could only propose, as the final decision was up to the bureau. Because of that, there were some trainees who could not take part in the first training that brought significant impact on the implementation of

DHIS. (ex. Wereda heads did not facilitate DHIS implementation at wereda level by supplying the necessary resource like access to computer for HMIS person).

Two training sessions organized by ORHB and HISP was conducted in Nazreth at the Malaria training center (August 16 - 30 2004 and December 16 – 21 2004). The training centre was equipped with 14 computers, a printer, photocopy machine and adequate furniture to accommodate 20 – 25 persons at one time which gave comfort for both the trainees and the trainers. The bureau covered all financial costs using the Ethio-Italian cooperation funds. A 20 page summarized DHIS training manual was prepared and given to all trainees by HISP which gives instructions on how to use the DHIS software.

The first training session targeted the pilot site system users where as the second the department heads, experts of the ORHB, and some zonal staff. Training was given to all weredas including those who did not have computer and electricity. The assumption was that those weredas without computers would use the nearest wereda and the zonal computers till they get their own computer. The second training also aimed to help scale up the system from the pilot zone to all zones of the Oromia Region. A total of 39 trainees took part in the two trainings. The following table summarises the number of people who participated in the two trainings.

| Training | Duration | Trainees | No of Trainees | Total |
|---|---|---|---|---|
| 1st Training | Aug 16 – Aug 27 | Wereda | 14 | 19 |
| | | Zone | 2 | |
| | | ORHB | 3 | |
| 2nd Training | Dec 16 – Dec 21 | Zone | 11 | 20 |
| | | ORHB | 9 | |
| Total | | | 39 | 39 |

**Table 6-3 Number of trainees involved in DHIS training**

The training had two parts. The first part basic computer training was given by the facilitator for a week while the second part, DHIS was given by the authors for an additional one week. Basic computer training was given to the staff of all weredas since all of them did not have prior computer knowledge and experience. The DHIS course covered data entry, data analysis, processing, generating reports and how to send the report to the next level via floppy disk. Generating graphs, interpreting data and information use was also discussed briefly, but due to the shortage of time and the absence of the domain knowledge (related to public health) it could be substantively discussed.

The short time allocated for the training and lack of prior basic computer knowledge amongst trainees had a significant negative impact on the DHIS training. For example, the trainees could not manage to copy a file from the computer to a floppy disk.

At the end of the training, trainees expressed their interests to learn more about computer software but they said they would not be able to apply what they have learnt from the training as they don't have access to computer. This problem was mentioned repeatedly during discussions, and also on the questionnaires that we had distributed. A trainee expressed his concern as follows:

> *I really appreciate your effort…and welcome you to solve our problem. No body has seen the HMIS problem…I thank you so much , I wish you success for your job…If we use this system that will be useful but I doubt, because we do not have computer…please tell them for the Bureau people this problem (HMIS person, WerHO, August 2004).*

The short duration of the training session was also described to be counterproductive by another trainee as follows:

> *The training period was too short for us that we did not have prior computer experience and also we may not get easy computer access to develop the knowledge through practice since the computer that we have in our wereda was assigned for malaria which is placed at the health center not at the wereda (HMIS person, WerHO, August 2004).*

We found most of the comments given by the trainees to be very appropriate and requiring immediate attention. The second training period served as a good forum to have a discussion with various staff from the bureau and zones. Feed back, comments, suggestions and ideas were collected to help better customise the software and to modify the data collection formats as well as to design a good strategy to extend the implementation to other zones. The comments received were very substantial, and provided by knowledgeable users with BSc and advanced diplomas in health science. Since the public health expertise was largely absent in the HISP side, these suggestions were very crucial to address our broader objectives of strengthening HISP to support health management. For example, two major comments received from this group about the system were as follows:

> *There is some mixed things here…both the WHO identified disease code used in health center and hospital; and the common diseases description that is used in Health Post and Clinic are mixed together which leads to make mistake, it should be separated (Trainee, ZHD, December 2004).*

> *…There are some diseases which are specific to one sex or age, for that, there is no need of sex or age choice. These disease codes should be identified and make some restriction to the required age and sex so as to avoid un-recoverable errors. Such as…This is very critical mistake was seen in the manual system before (Trainee, ORHB, December 2004).*

While we managed to address the first comments by designing the common diseases data entry screen, we could not deal with the second one relating to categorizing sex-specific and age-specific diseases due to time constraints. The following photos show the two training sessions which were prepared for the pilot zone and for the other six zones.

**Photo 6-3 The two phases of DHIS trainings**

**(August 24, Pilot zone trainees and Dec. 18, 2004 other six zones trainees left to right)**

- **Scaling up the system**

A plan to scale up the system and the processes from the pilot zone to all zones and weredas was made in July 2004. However, the approach of extending the software to all the weredas and the zones needed ample time and was constrained by the absence of electricity and basic infrastructure in the weredas. However, getting full coverage data was a significant issue to get acceptance of the system and making it sustainable. To try and balance the challenge of the poor infrastructure and the need for full coverage data at the region level, HISP and ORHB agreed to place the system in all zones, so that the wereda data could be captured at the zone level instead of capturing the facility data at the wereda level as was the case in Addis and also in the pilot zone of Oromia. The intention was to extend the system in the long run to the weredas; which could be enabled through the government's long term plan to connect the weredas through a WAN (Wide Area Network called Wereda-net). Since at the zone level, there is no possibility of getting facility data by the lowest level of aggregation, participants in different

discussions said that they preferred to mobilise resources to implement the system at the weredas. However, we considered the significance of the problem and the complexity of getting resources easily in Ethiopia context, and decided to scale the system in all the zones rather than wait for the computers in the Weredas. Accordingly, the zones took the initiative to install the system in their office without waiting for the RHB. We also assessed the availability of IT facilities and human resources in the zones to facilitate the implementation activities (See Appendix F).

- **Outcomes of the action taking**

As we did in the Addis case, here also, we concentrate on describing the observable outcomes which we could relate to the various action research interventions carried out to improve the existing inefficient and ineffective HII of the ORHB. Unlike the Addis case, in this region it was not possible to ensure the use of uniform data collection formats completely, nor also the software, as our action focus was primarily on the pilot zone only. As compared to the outcomes of the action research intervention in Addis, the out comes in this region can be described as relatively small. This was related to, as discussed above, to the contextual conditions including the large size of the region, lack of basic infrastructure, and insufficient human resource capacity, as compared to what existed in Addis.

In relation to the lack of infrastructure and the vastness of the region, two types of information flow were created; one electronically from the Eastern Shoa Zone and the other the existing information flow. The Eastern Shoa zone information flow was comprehensive in the sense that it incorporated all types of data; which were being reported in a fragmented way from the other zones. The following figure shows the change in the information flow in the Eastern Shoa zone and other zones existing information flow.

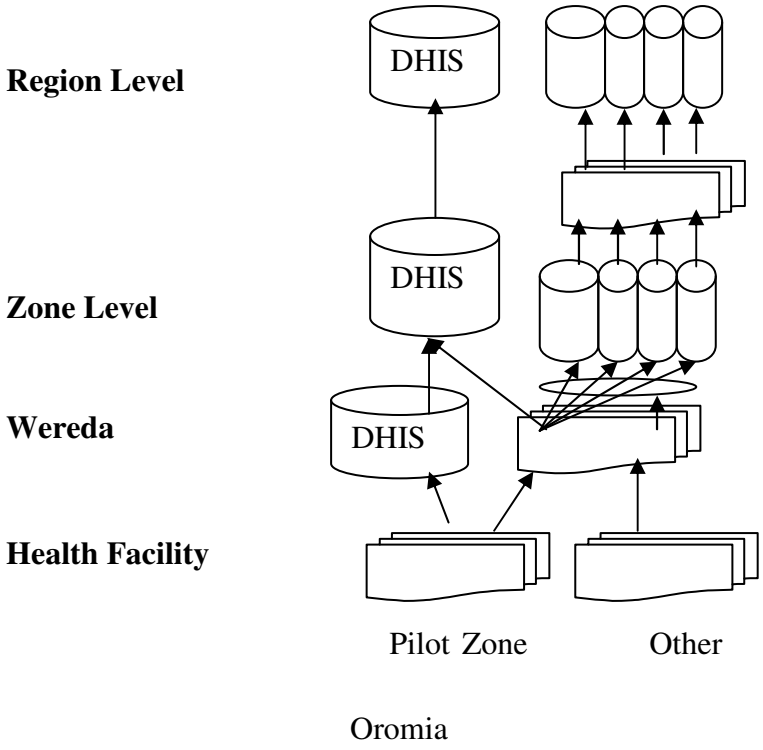


**Figure 6-5 Changes in the information flow of the ORHB**

Due to the introduction of DHIS in the region, the ES zone and RHB have got health facility level information. In addition to that, the probability of making errors during transcribing data from one level to another is being significantly reduced since data entry is handled only either at wereda or zonal levels. Currently, the zone and the RHB people have been pushing the lower levels to use the DHIS system as they developed increased trust and interests towards the system. The wereda level trainees' have been losing interest towards the DHIS due to the constraints of resources at the work place such as computers and the new data collection formats.

- **Evaluating the outcomes**

The evaluation of the outcomes of the action taking phase is directly related to the improvement of the HII in this research as was in the case of Addis. It is not by any means possible to say that there were significant improvements in the HII of the region. What we can however say here is we have introduced the seeds of change in one zone, and we were not successful to scale up these changes, due to different contextual factors. We plan to further these processes in subsequent action research iterations.

All the tasks identified in section on 'evaluating the outcomes' of Addis region would need to be accomplished in Oromia too. However, there are additional challenges which need to be dealt with relating to uneven distribution of infrastructure and the scale of the region, both of which place constraints on developing data at full coverage of the region. This leads to the identification of the following additional tasks:

- Additional support person;
- Organizing training for the remaining zones;
- Preparing proposals to government and non government agencies like CDC, Ethio-Italian cooperation organization and to the Ministry of ICT capacity development for additional computers and to get further financial support to organize training;
- Installation of the system in the remaining facilities; and,
- Finalizing the minimum regional data set and distributing the new data collection formats to all zones.

Using Table 6-4, we provide a comparative summary of the two regions studied with respect to the key features of the different facets of the action research cycle: situation analysis; action interventions taken; outcomes and the evaluations of the outcomes; and some inputs on further action.

As Table 6-4 shows the main difference between the two regions on the diagnosis phase were in the infrastructure and the size of the region which facilitated and constrained the scaling and standardizing processes. This also affected the action taking phase, and the outcomes in the two regions. In Addis, while we could cover up to the health facility with the new data set, reporting formats and system, in Oromia we could not extend beyond one pilot zone.

| Action research life cycle | | Addis Ababa | Oromia |
|---|---|---|---|
| Diagnosing | | The compact size of the region and the relative good infrastructure facilitated reporting in this region | The large size of the Oromia region together with the poor infrastructure had a negative effect on the data quality. As it was in Addis, here too data were being used only for reporting |
| Action Taking | Standardizing | Uniform secondary data collection format have been introduced in the entire region. The data set is still cumbersome and the work procedures are still inconsistent | The Addis data set was used as a point of departure. The basic things of the standardizing process are the same as Addis. But in Oromia it has been introduced only in one zone |
| | Local adaptation | Major adaptation on the south African system was made to include the MM module and to fit with the organizational unit and data set of Addis | Due to the advantages of being in the same country context, major adaptation on the Addis database was not needed. However, changes were introduced as to the organizational unit and some data elements |
| | Training | Two training sessions was conducted for the statisticians in the different levels. However, the course was dominated by | Two Training sessions was conducted for the HMIS personnel of pilot zone and for other six zones. The focus of the |

| Action research life cycle | | Addis Ababa | Oromia |
|---|---|---|---|
| | | how to use the system giving less emphasis to cultivate information use culture | training was the same as Addis |
| | Scaling up | Full coverage | Only in one zone out of the fourteen |
| Outcomes of the action taking | | - Standardised data collection formats<br>- trained users on how to use computers<br>- data processing and reporting using computers | The same us Addis. What is different is the coverage of the out comes |
| Evaluating the Outcomes | | The system is not fully improved and needs further improvement in the next iterations of the action research interventions | The system is not fully improved and needs further improvement in the next iterations of the action research interventions. The system and the best practices should be scaled up to all the zones to achieve improvement. |

**Table 6-4 Comparative summary of the two regions action interventions**

# 7 ANALYSIS AND DISCUSSIONS

## 7.1 Introduction

In this chapter, we present the analysis of the empirical findings which are discussed in chapters 5 and 6, by drawing upon theoretical concepts articulated in chapter 2. While we have presented a rather lengthy discussion of the case studies, our analytical focus in this chapter is on the processes of scaling and standardizing. The analysis presented in this chapter will help to meet the following two research objectives articulated in chapter 1; *1) To understand the nature of the challenges of scaling and standardizing in the context of HIS in developing countries more broadly, and in Ethiopia in particular, and 2) To explore the particular approaches and strategies used to address these challenges, specifically within the context of the health sector in Ethiopia.* Accordingly, this chapter is organised around three sections; section 7.1 analyzes the challenges to the scaling and standardizing processes respectively, while section 7.2 presents the cultivation approach as applied to the scaling and standardizing processes. This is followed by a discussion section (7.3),where we position our analysis with respect to some broader debates on related issues in IS research, and analyze some of the dilemmas associated in the relationship between scaling and standardizing.

The comparative case analysis design, we adopted, allowed us to examine how contextual conditions and variations such as geographical size, level of urbanization, and staff commitment influenced the processes of scaling and standardizing in the two regions. As the result of these contextual conditions and variations, the software and the standardized data set and reporting formats have covered all the SHDs and all the health facilities in Addis, within a relatively short period of time (one year). While in Oromia, the implementation has covered one pilot zone out of the fourteen zones. In this chapter, we summarize and compare key aspects of the scaling and standardizing processes in these regions with the aim to discern broader and more general issues and patterns.

## 7.2 Challenges to scaling and standardizing processes

- **Challenges to the standardizing process**

As discussed in chapter 1, our working definition for standardizing, in the context of HIS, is the process of developing and employing best practice principles and guidelines for collection, transmission and storage of health care data to serve as guidelines or communication gateways; (for example, essential data set standards) among health workers (physicians, nurses etc.) and different levels of the health hierarchies such as districts, provinces and national (Abdelhak, 1996, Braa and Hedberg, 2002 & WHO, 2003). More specifically, within the context of this research, through our empirical analysis, we identify the scope of the standardizing process to include the following four components:

**a) The data set(s):** Creating standards for data sets is a key component of HII (WHO, 2003). This component of the standardizing process in our research has the broad aim of identifying and collecting 'minimum but essential' data items. Data set standardizing also encompasses the design and implementation of a shared data dictionary to help collect data elements with in and across health facilities in a uniform manner (WHO, 2003). For example, in our case study, we identified different definitions given for the 'repeat' data element in the MM reporting format. The 'repeat' data element has managerial significance as it affects decision making processes since many repeat cases imply specific problems related to diagnosis.

Our focus on standardizing the health data set was mainly to remove data items which were redundant or unimportant for decision making, planning and action taking activities. For example, in the existing system, we could identify the collection of similar data items in the IDSR, MM and IMCI reporting formats which created an unnecessary and unwelcome work burden on the health workers. What was needed to achieve in the standardizing process was the functional integration of the nationally based vertical health programs to generate universal health data standards to be shared by the different

vertical and horizontal actors. In addition to this requirement of universality, the health data standards needed also to be flexible to accommodate the different health data requirements across the vertical and horizontal hierarchies of the health administration (Hanseth and Monteiro, 1997 and Braa and Hedberg, 2002). Given this understanding of data set standardizing process, later in this section, we will elaborate what we could and could not achieve during this process.

**b) The data collecting instruments**: Ensuring that data items are compatible across various data collecting instruments can be conceptualized as another key component of the standardizing process. In Figure 7-1 below, we first schematically depict the sub-components of this component of the standardizing process, and then elaborate on it in greater detail.

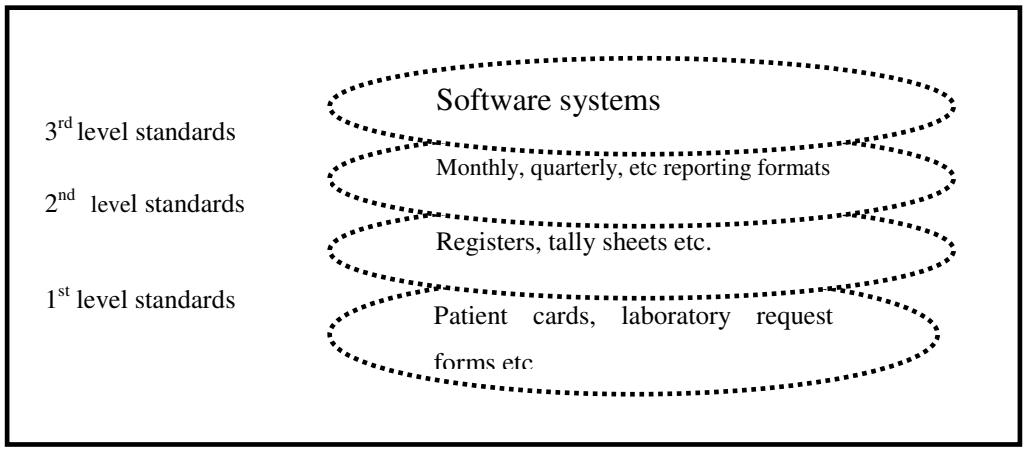


**Figure 7-1 Sub-components of standardizing the data collecting instruments**

The figure illustrates three levels of standards. The 1st level deals with data elements being collected using the very primary data collecting artifacts such as patient cards, laboratory request forms etc. Data once registered in its primary form needs to be compatible with the next level of data collecting instruments such as registers and tally sheets. For example, the data elements that are not indicated in the laboratory request form should not be included in the laboratory registers. This level of standards is often neglected. However, this level is indeed very significant to bring improvements to the

HII. For example, in our case study we were able to observe that in the registers and monthly reporting formats of laboratory service, the 'sex' of the patient or client who got the service was required. However, the laboratory request form did not identify 'sex '. In this case, to make the report complete, the health workers filled in the 'sex' based on the name of the client or the patient. This often led to poor quality data as a name can serve for both sexes, for example, Meseret. The 2nd level emphasizes the need for compatibility of data items of the registers and tally sheets etc with the monthly, quarterly and annual reporting formats. For example, data elements that appear on the 'antenatal service' monthly reporting should also appear on the 'antenatal' registers. In the third level, the emphasis is on creating a consistency of data elements as collected at the earlier two levels with the data being entered into the computer-based ISs and the generated reports. For example, all the data elements for antenatal service reporting format should be included in the computer system so that the computer will generate required antenatal reports and indicators.

This multi-level depiction of standards implies that how each level is connected to the other, and improvements cannot be introduced in the HII merely by introducing computers, but through improving the standards right from the level at where it is registered to how it is transferred to registers and then the reports. These sub-components are interdependent in the sense one can not function independently of the other. Therefore, standardizing of data collecting instruments at multiple levels is crucial to ensure compatibility over different vertical levels, and also across the horizontal levels of the sub-cities/weredas, zones or regions.

**c) Software system**: While we were summarizing the problems observed in the existing HII of Addis Ababa and Oromia regions, we have mentioned the technical fragmentation of the overall HII. Each of the health program experts had his/her own software system which was being used for data processing, reporting and storage purposes. Most of these systems, for example, MS Excel and Epi Info, were not real database applications that facilitate the integration of the health data analysis and

interpretation activities to support managerial decisions. Furthermore, since these fragmented systems have historically been serving the interests of specific groups (for example, analyzing surveillance data by surveillance experts and for their own needs), there was little possibility of getting comprehensive health data from the available computer system. Therefore, there was a need to implement a standardized health specific software system which integrates the technically fragmented systems and can potentially provide a comprehensive health data analysis tool.

Accordingly, our scope of standardizing includes the design and implementation of a comprehensive database application tool called DHIS software. To accomplish this, we used the DHIS software which has been used in the South African health care sector. As the software has been developed for the health domain in another country context, it was easier to make it a standardized technical solution for the Ethiopian health care sector through a local adaptation process. However, there were challenges associated with standardizing the software systems which we explain later in this section.

**d) Work practices**: Work practices are related to the processes surrounding how health workers perform the data collecting, registering, and reporting. As discussed in chapter 5, most often such work practices are executed conforming to the traditional way of doing things which as argued (in chapter 5) leads to poor quality data. An example of this concerns the inconsistency in practices around how data is being registered in the hospitals - ('on admission' or 'on discharge'). Some hospitals used the first criteria and the others the second. For example, inpatient data registration procedure being practiced in some hospitals or wards is based on an 'on admission' procedure which tends to omit patients from being counted for the current month. In some hospitals, the practice for such similar registration was based on the criteria of 'on discharge'. Such inconsistent work practices contribute to both double and under reporting and with adverse influences on the HII. For example, in some health facilities data on growth monitoring were collected from the IMCI section only and in others the same data were being collected

from both the IMCI and EPI section which adversely affected the quality of the IMCI data.

By defining the scope of standards to include data sets, the data collecting instruments, the software system and also the surrounding work practices, we emphasize the complexity associated with the HII and the constituting standardizing challenges. This emphasis resonates with earlier arguments made by researchers, for example related to the EPR systems (Nilsson, Grisot and Aanested, 2005), Telemedicne (Aanested, 2003), and Spatial Data Infrastructures (Georgiadou, Puri and Sahay, 2005). Complexity arises both from the multiplicity of standards in place, the various levels of sub components, and also their interconnectedness.

Due to this complexity of the standardizing process, the HISP team in the two regions could not achieve the level of "ideal" standards required to bring significant improvements on the existing inefficient and ineffective HII. We now discuss the specific challenges experienced in each region with respect to the standardizing question and what was achieved or not. We argue that these challenges can be deeply understood through the concept of installed base and its emphasis on history. Hanseth and Monteiro (1996) have described installed base as representing something which was already existing, and any attempts to improve and extend an II like a HII, including the implementation of standards, needs to take the installed based as the point of departure.

In the context of the HII under study in the two regions, the installed base consists of the historically existing cumbersome and unwieldy data sets, fragmented and inconsistent data collecting instruments and software systems, and un-standardized work practices. The standardizing process in both regions did not start from scratch; rather it was an extension of small scale changes to the already existing regional data set, the data collecting instruments, the software systems, and the historically situated work practices. As this installed base is embedded in a complex social, political and cultural context, the standardizing process is also subject to these contextual influences which both provide

challenges and opportunities. In our analysis, we identify six sets of key challenges to influence the standardizing process: lack of national level involvement, poor culture of information use, inadequate public health inputs, time and logistics constraints, large geographic size and contextual difference in health systems. These challenges are now discussed:

***Lack of national level involvement***: The existing HII comprised a number of 'islands of standard data sets', which were managed by and serving the interests of specific groups of people representing the vertically organized and nationally based health programs. Lippeveld (2000) and also Braa (1996) have argued that the overall health service can be improved only by integrating these data islands to produce a comprehensive, 'minimum but essential', and shared amongst all the relevant actors dataset. However, in our case, while the health program experts at the regional level participated in the entire process of standardizing the health dataset, the outcome was adversely affected by the lack of involvement of the national level, representing the political context, and where all the program-based health reporting formats find their origins. Participants, especially from the levels below the region, in the standardizing process (such as in workshops and seminars), were afraid and resistant to change or delete unimportant and redundant data elements from the installed base of the historically existing datasets. The fear stemmed from the possibility of reprimand from the higher levels of removing something useful, and also the need to collect more (rather than less data) in order to show to the superiors that they were "working hard." Rather than reducing the already unwieldy datasets, the suggestions mostly were towards adding new elements.

Therefore, the outcome of the HISP standardizing work in Addis Ababa and Oromia, to integrate these islands and contribute to the development of a common shared data set, can be described as being of "maximum" rather than 'minimum" or "essential.' Our outcomes can be described using the metaphor of a stapling exercise where we managed to consolidate the various data sets of the different programs into one, a stapled set, but could not be taken to the next step of discussion and negotiation to move to something

minimum and essential based on diversified interests of all the actors in the network of HII. On the positive side, we can argue that standardizing should be seen as a longer term process and not a one time exercise, and creating the essential data set would not be possible without having this maximum data set in place. Only when we know what exists in the overall health system, can we move towards a discussion on how the simplification can take place.

***Poor culture of information use***: In the context of the health sector, information use culture can be conceptualized as the capacity to be able to use the routine data being collected by the health staff to guide local action, for example, the MM data can potentially help the health managers to know the disease distribution in their catchment areas and to procure drugs accordingly. Such a focus on information contrasts with the typical practice existing in many developing countries where the data collected is primarily used for reporting purposes primarily to satisfy the needs of the bureaucracy. Wilson (2000) has described the poor culture of information use to adversely influence HII improvement activities in most developing countries. Similarly, the HISP health data standardizing process was challenged by a similar poor information use culture in the two regions. This culture spans a number of interconnected elements such as the definition of data elements, having standard reporting formats, the use of analytical tools like graphs, tables and maps which can aid decision support.

Even for data elements that did not require to be sent to the national level, it was found that it was difficult to remove the unimportant and redundant ones, as the existing culture was one of where users prefered to collect and report every thing, in fear of reprimand from the higher levels, and to show that they are working hard.. Braa *et al.* (2005) describes this tendency of collecting everything as an interest of 'nice to know' rather than 'must know'( which is based on the use of information). Information use was also impeded by the manual based data which had non existent analytical tools, such as the ability to draw graphs and charts, that made it difficult to develop uniform analysis across the health facilities and also over time. Also, since there was a lot of local improvisation

taking place in creating data collection instruments when paper ran out or photocopying facilities were not available, there was a lack of unformity and standard in these instruments which also impeded the standardizing effort.

Thus, in summary, the information use culture reflected in the datasets, collection instruments and the existing practices around the HII, all contributed to challenge the standardizing process.

***Inadequate public health inputs in the HISP team***: Due to the organizational, technical and managerial complexities, Lippeveld (2000) has suggested the organization of a multidisciplinary team to be responsible for the development and implementation of the HII reform processes. However, in our case the HISP team was dominated by informatics staff and nearly no public health inputs. For the standardizing process to be effective, the HISP team needed to negotiate and translate the 'nice to know' interest of the health workers to the 'must know.' In the absence of the public health inputs, the HISP team could not negotiate with the users' as to the relevancy of each data element based on medical considerations, but could not only do so from an informatics viewpoint. This inadequate composition of the HISP team restricted the process of standardizing the health data set.

***Time and logistics constraints***: The 1st and 2nd level standards which was supposed to serve as a gateway between the patient cards and labratory request forms on one hand and the registers and the monthly reporting formats on the other, could not be adequately achived due to both time and logistics constraints. Therefore, there still remains a certain degree of inconsistency between the various data collecting instruments which contributes to the generation of poor quality data. The HISP team, recognizing the impotance of this 2nd level standards, has designed and handed over sample registers to the RHBs. However, due to lack of paper, the reporting fomats could not be distributed widely to the health facilities. This logistics problem was more aggravated in Oromia, where we took too much time to distribute the monthly reporting formats to the wereda

and health facilities of pilot zone, due to insufficient paper supply. As to the 1st level standards, the HISP team did not give the issue appropraite attention, and this was related to time constraints. However, it is our reccomendation that in the next phase of the action research iteration, there should be greater focus on strengthening this level of standards which is fundamental to the improvement of the overall HII. What was totally unaccomplished by the team was the standardizing of the work practices because of the limited time the HISP team members had, and also making changes in work practices is a much more complex, time taking and historically embedded process, which takes more time and effort to change than the technical tasks.

***Large geographic size:*** the above mentioned challenges (politics, culture, time, etc) were common for both Addis Ababa and Oromia. An issue specific to Oromia was the large size of the region, coupled with the problem of poor transportation facilities which hindered firstly users from taking part in standardizing workshops, and also the researchers from taking the standardized data sets, data collecting instruments and the DHIS software to particular health facilities. Users, due to this lack of participation, could not be made aware of the benefits of standardizing, and were weakly motivated to use the standardized data set and reporting formats. In contrast, in Addis, the standardizing process was facilitated by the compact size of the region; where a fair amount of users from all levels participated in the standardizing process, and its benefits were more easily visible for them.

***Contextual differences in health systems:*** When trying to standardize the computer system, the main challenge was the difference in information need between the South African and the Ethiopian health care sector. In Ethiopia, the MM data have been collected using the WHO ICD code list while in South Africa there is no need for such kind of data. Accordingly, in the original DHIS software where data elements are presented as a list, it was not possible to incorporate the 150 list of ICD codes which are further divided to sex and age. On the other hand, the client organization (RHBs) claimed to not accept the software unless they are able to process these data. In addition, the

difference in the dating system between South Africa and Ethiopia was another challenge, for example, to make use of the TB module which was also developed for the South African health care system. Furthermore, while the Addis Ababa RHB is organized in four organizational levels, the South African Health care sector is organized in five organizational levels. These all were challenges experienced while trying to create a standardized computer system which can be shared by all actors in the HII network. The challenges were addressed through the use of different cultivation strategies that we discuss in section 7.3.2.

In summary, building on the broader perspective of II implies that standardizing the HII can not be seen as a single process but a set of multiple processes comprising of complex interdependent components (data set, data collecting instruments, software systems and work practices) which are deeply embedded in the broader social, cultural and political context. In addition to the complexity of the components, the multi level nature of the health sector makes it impossible to make changes at one level or component without influencing the above. Creating standards that are flexible, and sensitive to the hierarchy which exists at different levels, is fundamental in improving the existing HIS. The challenges experienced during the standardizing process clearly demonstrate the complexity and heterogeneity of factors (lack of national level involvement, poor culture of information use, inadequate public health inputs, time and logistics constraints, large geographic size, and contextual differences in health systems in the health systems) that influenced both the process and outcomes. These factors are deeply embedded in the political, cultural and material contexts, and any shift requires the acknowledgement of what already exists; the installed base. The cultivation approach (Hanseth and Monteiro, 1995) provides us with one possible approach to address these standardizing problems while respecting the installed base. This is discussed later.

- **Challenges to the scaling process**

As discussed in chapter 1, the perspective we take on scaling is the expansion of an artefact , a system, 'best practices' or procedures and routines for use from a certain point of its origin to both vertical levels (for example, from facility to district to province) and horizontally (for example from one district to another). In the context of this research, we describe the scope of scaling to include the following four facets: geographic, functional, experience and learning, and level of use. These features are now briefly discussed.

**a) Geographic**: this concerns the expansion of the data sets, the data collecting instruments, the software systems, and work practices from one facility to all other health facilities/weredas (sub-cities)/ zones to get full coverage data. Scaling in geography increases the number of users and related activities; for example, the number of training sessions, trainers etc. The geographical coverage achieved in the two regions is depicted in figure 7-2 below.

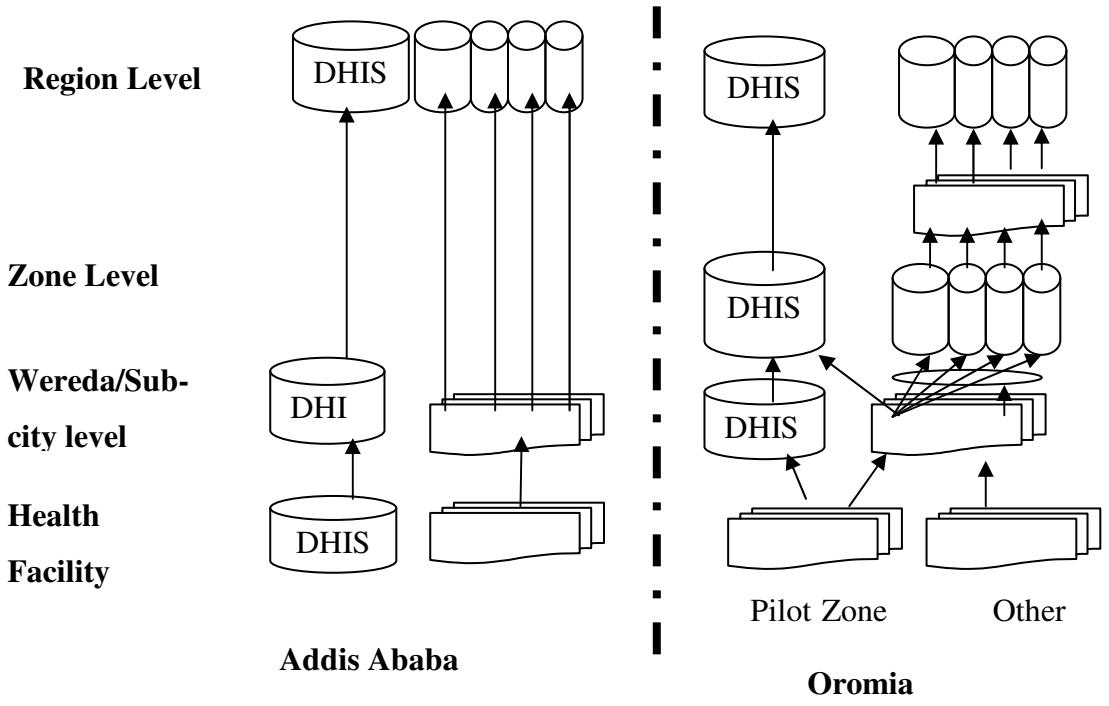


**Figure 7-2 Geographic coverage in Addis Ababa and Oromia**

As shown in the above figure, in Addis, all sub-cities were covered with standardized data sets, data collecting instruments and the software system (DHIS) over the period of a year. This process continued relatively quickly down to the 23 major health centers and subsequently to the five hospitals. However, due to factors that we discuss below, it was not possible to cover all the horizontal (health program) departments using the DHIS software in both the regions. Therefore, for example in Addis, a parallel reporting system which starts from the sub-city level was identified. In this flow, as shown in the figure 7-2, the reporting was done manually and applications such as MS Excel and the Surveillance system were used for data processing at the regional level. The second flow of information was what which already existed before the formation of the reporting system using the DHIS software. Here, it is to be noted that, it was only in the DHIS software component that full horizontal coverage could not be achieved in Addis and in the Eastern Shoa of Oromia. That means the spread of the standardized data set and monthly, quarterly and annually reporting formats have been achieved in all the

departments, but not the DHIS. This implies that given the poor infrastructural conditions, it is relatively difficult to scale the technical systems due to the constraints in providing support.

In Oromia, a similar vertical scaling was much more difficult to implement. Here, the HII recording and reporting activities of the lower levels of the health administrations, from the health facilities to the Wereda Health Offices of the zones (other than the pilot zone) needed to be carried out manually, and the previously existing inconsistent data sets and data collecting instruments remained largely unchanged. In the pilot zone, the computer and the paper-based system met at the wereda level using the standardized monthly, quarterly and annually reporting formats to serve as an interface. There were other heterogeneous factors that influenced the non achievement of full coverage data in this region. We discuss some of these factors briefly later in this section.

**b) Functional:** As time passes, and the expansion covers a larger geographical area, and with additional user needs, the functionality of the system should also be expanded to accommodate these changing and different user requirements. For example, in our case study, while the system was scaled up geographically from Addis to Oromia region, the functionality of the system needed also to be expanded to include more data elements, data element categories, and reports to satisfy the interests of the new group of users which were included to the already existing HII. Functionality does not only imply a technical functionality of software features, but also encompasses the skills and capabilities of the users to be able to use these enhanced features.

**c) Experience and learning:** The experience gained from the sub-cities of Addis region helped us significantly to approach the scaling of the system both geographically and functionally to Oromia region horizontally and in the health facilities of Addis vertically. The experience gained from one point was used as a point of departure for another level of expansion. For example, as we learnt that the MM data is the main requirement and is included in the current DHIS for Addis Ababa region, we used it as a

means of getting access to start work in Oromia region. And what we learnt from Oromia region, for instance, the need for 'common diseases' data entry screen increased our experience and helped to scale the computer system (DHIS) to Amhara region.

**d) Level of use**: With time, with the conduct of various training sessions, workshops and discussions, the users' level of using computers and the DHIS software increased. With this, we can even see some examples of the changing patterns of use of information. For example, in a recently concluded regional level workshop, managers from some facilities in Addis Ababa region described instances of how they had started to make graphs and charts to help guide their local action. Also, in a recent MOU signed between Addis region and HISP Ethiopia, the region has made the request to expand the functionality of the system to also include personnel and pharmaceutical databases. However, a similar level of scaling of use was not seen in Oromia region for various reasons such as the narrow geographical scope of the activities as compared to the large size of the region, the shorter time period, and also the lower level of engagement of the health staff there with the new systems as compared to Addis. In summary, scaling in the level of use not only implies more intensive use of the HII, but only an increasing sophistication, for example to use the software not only for reporting but also for analysis to support local action.

Sahay and Walsham (2005) have argued in their paper concerning the challenges and approaches to scaling of HII in the PHC sector of Andhra Pradesh, India that scaling is not only a technical process but a complex heterogeneous socio-technical process. This argument is also reinforced through our analysis in the two case studies in Ethiopia. We now discuss some of these heterogeneous factors that challenged the scaling process in Ethiopia, and led to uneven outcomes in the two regions.

***Uneven infrastructural development:*** There are many similarities between Addis and Oromia; the health systems and programs, governmental policies and structures, as well as the basic HII reporting structures. These similarities imply that we need not reinvent

the wheel, and the data set, reporting formats and the DHIS software developed in Addis could provide the point of departure for Oromia. However, these two regions are also very different in terms of their economic and infrastructural development. They are different even in their language, ethnicity, politics and health issues. These differences contribute to the very different levels of scale of the HII improvement process achieved in the two regions.

Contributing to these different levels of scaling achieved was the uneven development of infrastructure (in terms of transportation facility, electricity, telephone etc) horizontally between Addis and Oromia region and also even between urban and rural areas of the Oromia region. These differences made it difficult to scale the 'best practices,' both in terms of geography and functionality from Addis to Oromia region and also vertically within the region from the pilot to other zones. Vertically, the health hierarchies can also be seen to be unfairly and unevenly resourced. For example, even if it was easy to implement the software, with easy access to computers, in the SHDs of Addis, to do so in the health facilities was much more difficult because, amongst other reasons, of the absence of computers in many of the facilities. However, with the commitment of the RHB and the SHD in providing the necessary resources, it was possible to cover all facilities in a relatively short period of time. The commitment of the authorities was heightened when they could see the benefits of the DHIS processes in the sub-cities, and realized that trying to reach to full scale (all facilities) would help them to strengthen the overall HII.

In contrast, in Oromia due the lack of basic infrastructures (electricity, poor road etc) in most of the weredas and the health facilities, the scaling of the standardized data sets, data collecting instruments and software system have been limited in one zone only. The infrastructure problems in Oromia region was not something which can be improved by a good commitment of the health managers as it was in Addis. This is something which is related to the larger situation of poverty in Ethiopia itself. For example, the absence of

electricity and good roads can not be solved by the commitment of health mangers but through a nationally driven reform process.

***The presence of legacy IS-the installed base****:* Prior research has established that the presence of legacy ISs influence the introduction of a new HII. For example, Nhampossa and Kimaro (2004) describe how the introduction of DHIS was significantly influenced by the existing legacy systems, both in technical and institutional terms. In Mozambique, a spaghetti of legacy systems (Nhampossa, 2004), due to various technical factors (outdated platforms, poor documentation etc) and institutional conditions (interests of certain health staff to continue with a particular system) impeded the introduction of the DHIS.

Our case also emphasizes that not only in their introduction, legacy systems also significantly impede the scaling up of the HII. While in Mozambique and Tanzania, Nhampossa and Kimaro (2004) emphasised the legacy of specific HII (such as SISProg and MUTUHA in Mozambique and Tanzania respectively), we emphasize, in addition to the HII specific applications, the presence of general applications such as MS Excel to also hinder the spreading of computer-based systems from one place to another. For example, the fact that MS Excel was being used as a data processing and reporting tool implied that all the horizontal departments in the region could not be covered. Even if MS Excel does not have database functionalities, the preference of the users for MS Excel restricted the interests and motivations of the users to use the DHIS software.

***Varying management commitment***: In Addis Ababa region, the sub-city and regional administrators, who had a strong interest and motivation in improving the current HII, played a significant role in supporting the scaling up of the system. This commitment was expressed through providing the necessary permissions, the provision of infrastructure like (computers, papers, diskette etc), and resource to organize and enable participation in workshops where learning experiences could be shared across the facilities which supported the scaling processes. Such workshops were more difficult to organize in

Oromia because the health bureau staff was busy by other activities, and there was not the strong institutional mandate existing which gave priority to the DHIS implementation.

***Large geographic size**:* The large geographic size of the Oromia region was a key challenge for achieving full coverage of data as compared to Addis which is geographically more compact, smaller, and thus relatively easy to cover. This compactness facilitated a greater degree of user participation, access and support, which significantly contributed to the scaling up processes. In a large area like Oromia, system introduction necessarily has to be done first in small pilot sites, considering the poor infrastructure, and then slowly expanded. The scaling process from the pilot zone to other zones required additional support staff and transport facilities to travel to new areas. Also, since the experience of users' with computers was also limited, greater support was also required. However, these issues were difficult to solve because of the large size of the project coupled with the relatively poor level of resources (people, transport, budgets) available to the project. For example, the vastness of the Oromia region implies the need for employing additional support staff so that the users feel that they have someone to help when they face problems in their vicinity.

***Differences in organizational structure and functional requirements**:* While the Addis Ababa region was organised in four hierarchical levels, the Oromia has five levels to account for its large geographical size. In addition to these, there were specific functional requirements of the region that needed to be addressed while the system was being scaled here. For example, because the Oromia region was known to be a malaria prone area, a major requirement of the region was to collect data on malaria which was not the priority in Addis Ababa region. The other example was the need for gathering and processing environmental health data in Oromia region, a practice that had been discontinued in Addis Ababa region in 2005 with the establishment of the Beautification Agency under the city mayor. These two examples, and also other similar issues, had implications on the technical (functional) scaling of the system, as more time and resources were needed

to be invested into the development of these additional features, resources which were not easily forthcoming.

In summary, the heterogeneous socio-technical factors (geography, history, technical, institutional etc) that are embedded in the broader HII context influenced the scaling up of the DHIS software and the associated elements such as the reporting formats. This indicates that, firstly, strategies need to take into consideration these given factors, and secondly, given appropriate strategies and sufficient support and resources, making improvements in the HII are possible, even in such complex conditions. Given this rather "development optimistic" perspective, the II perspective emphasizes that dealing with these factors is a non-trivial matter, and requires addressing the complex and heterogeneous nature of challenges to both the horizontal and vertical scaling processes. The II perspective guides us to the use of a cultivation approach, which we now describe as was employed in our case study sites.

## 7.3 The cultivation approach to address the challenges

When the DHIS software was moved from South Africa to Ethiopia, it was not only the technology which was transferred, but also the methodologies and training approaches (user participation, evolutionary prototyping etc) and also a philosophy (bottom up, empowerment of health workers etc). As the team members were students of the University of Oslo where HISP is integrated in the research and education processes, the "HISP methodologies" are also being transferred through formal education processes. For example, courses taught in Oslo on IS and organizations emphasize ---user participation, incremental system development etc. Despite knowledge of these techniques and concepts, they are difficult to apply universally in practice since the installed base and contextual conditions in the different settings vary, and cannot be unproblematically transferred.

Here, it is to be noted that the general HISP approach considers technology transfer as being better regarded as technological learning (Braa, *et al*. 1995) rather than merely a transfer to the artefact from the north to the south. This sensitivity to the scope and complexity of the transfer process helped us to accordingly anticipate possible factors and devise appropriate approaches to address them. And we believe that the methodologies that were transferred through the formal education process helped us to acknowledge the installed base and its influence on the processes of scaling and standardizing. However, there are aspects which are specific to the context and makes difficult to address scaling and standardizing challenges based on the knowledge gained from formal schooling. The theoretical concept of technology learning, however, helped to provide us a broad guiding framework to develop mechanisms to enable how developers can learn about the development context (for example through user participation); and the client organization learn about the artefact and the system (for example, through training and workshops). We argue that it is the interplay of these two kinds of learning processes that contributed to relatively successful outcomes of the efforts to change and improve the HII in Addis and Oromia.

Our approach to address the scaling and standardizing issues in the two regions can be described as reflecting a cultivation approach; which we argue can support the interplay of the two forms of learning discussed above, and described by us through the concept of technology learning. As discussed in chapter 2, the cultivation approach can be seen to comprise of many methodologies (e.g. participatory design, prototyping, use of gateways, boot strapping etc) that can be used and adapted in particular contexts. Now, we discuss how the cultivation approach was particularly adapted and used by us to address the scaling and standardizing challenges in the two regions.

- **The cultivation strategy for the standardizing process**

The approach followed in the standardising process of both the regions can be described as being one of cultivation, which reflected the inherent assumption of the difficulty and impossibility to bring radical change in the installed base comprising of the data sets, data

collecting instruments, software system and the work practices that have historically existed. As the levels and health programs in the health sector are interconnected, changing one without affecting another was impossible. For example, changing what data elements are recorded in the health facility influences what indicators can be calculated at the federal level. The implications thus is to start small, and to try to change something which minimizes the influences on other parts of the network

The approaches and strategies that we used to cultivate the standards to improve the overall HII can be summarised as the following; modularization, *user participation*, *evolutionary prototyping and incremental* approaches. We now give a brief description of each of the strategies as they have been dealt in existing literature discussed in chapter 2 and then we will discuss how it was applied in our case.

*Modularisation* is a process of constructing a hierarchical layer with standardised units allowing flexibility and variety in use (Hanseth and Monteiro, 1998). The standardised units serve as a gateway or interconnection mechanism of the different modules.

*User participation* is an approach to involve would be system users in the process of system cultivation processes (Bødker and Iversen, 2002).It is believed that user's involvement in system development can reduce the inherent tendency of human beings to resist new innovations. It also increases the knowledge of the developer about the system development context. Based on empirical studies, researchers have suggested different user involvement strategies taking into consideration the context (see for example, Puri *et al* 2004 and Byrne, 2004). *Evolutionary prototyping* is a method of evolving software and clarifying requirements (Sommerville, 2001). This approach presupposes participating users to understand their requirements.

> *Incremental approach* in system development has been discussed by Sommerville (2001) as a strategy of choosing a priority area, developing a system, and giving it to the users. Once the developer has a working module for the priority area, he/she will continue working on the other areas while getting feedback from users. This description of incremental approach may lead us in concluding incremental approach to comprise of the modular and user participation strategies which presupposes the construction of layers of priority areas and requires the involvement of user to get information about the priority areas and to further develop the system.

We can say that we took *modularization* as a first strategy for cultivation in the standardizing process. This implies that the standardizing process, as indicated in figure 7-1, was divided into three levels and carried out based on the ease of implementing changes as compared to the other levels, and also while minimizing the resource requirements. The layers are flexible in the sense that the data elements that appear in the lower level can be more than the data elements that appear in the upper level. However, all data elements that are found in the upper level should also be found in the lower one.

We started the work in standardizing the 3rd level which in turn required the setting of data sets as a prerequisite. Based on the already existing data set; the installed base, the data set was established by involving users from different levels of the health administration. This approach helped to understand the information needs in the respective regions. The software training sessions and workshops were used to involve the users in the standardizing process and gain their feedback.

However, since we did not have the active support and guidance from the national level which is the key actor in the issue of standards, we were not able to focus on the 'real integration' of the fragmented system by establishing formal standards across levels and develop a shared Essential Data Set for the health sector. Small scale solutions means, for example, collecting all the reporting formats and sorting them out in practical ways so as

to reduce the discrepancies between them with respect to definitions (e.g. the different forms for ANC services had different definitions of "visits") and overlaps (e.g. diagnosed diseases collected by multiple systems). This "streamlining" approach then had to be carried out both horizontally (between health programs) and vertically (from facilities and upwards to RHB) within the health hierarchy. We expect this standardising process to continue in the future, both because the current solution is not ideal, and because more actors (e.g. health programs) are getting interested and committed to this process. This will invariably lead to innovations and further changes. The interest of the Addis Ababa health bureau staff to decrease their number of forms and the data elements being collected illustrate such an increased awareness, especially among the top regional managers.

The HISP Ethiopia approach in setting the data set was not similar to that reported of HISP in South Africa (Braa and Hedberg, 2002). The experience in South Africa was aimed at collecting only those data elements (called minimum data sets) that would be useful for the calculation of indicators at each level through a process of consensus building among heterogeneous actors (Braa *et al*, 2002). Recognising the different information needs in the health hierarchies, the HISP South African team was guided by the principle of 'hierarchy of standards' to define the national data set. Through this principle the lower levels have the right to add their own data elements while adhering to the needs of the data sets required at the next higher level of the administration hierarchy.

The particular situation in South Africa following the fall of apartheid created the mandate for the whole health system to be redesigned. Opportunities for making similar scale of changes were not found in Ethiopia in this historical moment. As a consequence, the process in Ethiopia has developed differently. Given the more constrained political situation in terms of potential for change in Ethiopia, the approach here has aimed at making smaller scale changes without a strong political mandate than in South Africa. In Ethiopia, it has not been possible to get together all the actors and health programs in order to agree on a core set of common standards, as was possible in South Africa. While

the approach in South Africa was to agree on a "minimal but essential core set of data elements", in Ethiopia may be seen as "establishing a maximum data set that is as consistent as possible". The "maximum data set" in Ethiopia was created by 1) pulling together all data collection forms that were used and then; 2) solving the inconsistencies between the forms in terms of definitions and overlaps in such a way that the data elements could be defined in the DHIS database. A "data warehouse" approach is another but complementary way to label the methodology followed in Ethiopia. The data warehouse established through the DHIS aims at including all data that are being collected in the health sector. The standardising has then aimed at making the "maximum data set" internally consistent and to some extent rationalised by reducing the total number of data elements. The 'maximum data set' forms the base for standardizing the monthly and quarterly reporting formats.

Furthermore, our general approach of choosing the less complicated and minimum resource required areas and making the other areas to wait implies the use of an *incremental approach* in the standardizing process. For example, since changing the surrounding work practices was much more complicated than standardizing the monthly and quarterly reporting format, we left the former case to be considered in the next action research iteration.

*Evolutionary prototyping* was used to design the DHIS software. First, the requirements of the RHB were identified using interviews with the RHB staff and assessing the documents. Accordingly, the software was designed to include these initial requirements. For example, through this process we could identify the need for MM data. This initial version was used for giving training to the users on how to use the software. This time, the users gave feedback on what is required by the RHB but were not included in the software. They also gave valuable comments which were used to clarify some technical errors. For example, mistyping the name of data elements. Further comments and feedback were also received after the system was implemented in the SHDs and health facilities. The subsequent trainings were also used to get further requirements. In all the

cases, the software had been modified to include the requirements and installed in the users' place iteratively.

- **The cultivation strategy for the scaling process**

Our cultivation strategy to address the scaling challenges can be described as being the use of incremental, gateway based, and flexible approaches. This together can be described to represent the 'network of actions' approach as advocated by Braa, Monteiro and Sahay, (2003). The 'network of actions' refers to the sharing of the data set, the data collecting instruments, the training manual, the experience and the DHIS software from Addis to Oromia region horizontally and to the lower and upper levels in the same region. In this case, the experience gained from Addis facilitated the work in Oromia region as we were informed about the information needs and infrastructure constraints within the country context. For example, as the MM module was included in the already existed MD module of the DHIS software, there was no need to do it again while the work was expanded to the region. In order to create the 'network of action' with in Ethiopia, we used the strategies and approaches that have been specified above. We now discuss how the cultivation approach has been applied to scaling the standards horizontally and vertically in the two regions.

Our first approach to cultivate the scaling process was the use of *flexible* standards. While the system needed to share important features across all the regions and the vertical hierarchies, there was a need to give the users the possibility of incorporating their own additional information requirements as per their local and changing needs as the scaling took place both horizontally and vertically. The flexibility of the DHIS to address functional requirements was a great advantage for scaling the system across the regions. The need for flexible strategy may be more important in developing countries, like Ethiopia, than in industrialized countries, because of a) more uneven development between and within regions, and, b) the important role of donor funded health programs which dominate the overall functionality of the health care system, and contribute to

ongoing changes in the HII (e.g. the recent inclusion of HII to support HIV/AIDS programs) (see Braa *et al*. 2005). The flexibility of the system is important to go in line with both the computer and the paper-based systems. In the areas where there are infrastructural problems, the paper-based system needs to be maintained while in the urban areas, the computer based systems are important. The standardized reporting formats served as a *gateway* between the computer (DHIS software) and the paper-based system (the reporting format). The gateway strategy helped to address the infrastructural problems that were hindering the system expansion down to the health hierarchies and across the regions and facilities.

We also used a *simple* computer system to account for the shortage of human resources in the rural regions in general and the unavailability of computer experts more specifically. This helped to manage minor but important changes in the system through the limited computer knowledge that was available at the working place. This facilitated the expansion of the system to address well resourced areas.

Recognizing the difficulty of changing the complex factors that challenged the scaling process, we followed a small scale *incremental* expansion process. For example, in Oromia we started in one pilot zone and then we planned to expand the system in all the zones. This, we thought, would help to get full coverage data that the region was then asking. The next step would be to vertically scale down the system down to the weredas where the possibility of getting data at the correct level. In Addis, the scaling process was assumed to continue to cover all the health programs so that they can share the DHIS produced reports and take the advantage of the computer based systems.

## 7.4 Discussion: the dilemmas of scaling and standardizing

The challenges of scaling and standardizing have been identified as major issues by various researchers in the development of an effective IS in general, and HII more specifically in the context of both developed and developing countries. For example, Hanseth, Monteiro and Halting (1996) have elaborated on the issue of standardizing drawing upon the example of the internet infrastructure. They have emphasised the technical standards (protocols) to enable the internet to serve as shared resources amongst the various heterogeneous actors. They explain that the challenges of scaling and standardizing of technologies, like the internet, cannot be achieved in a geographical sense without the application of shared international standards like IP (Internet Protocol) (Monteiro and Halting, 1996). Sahay (2003) has argued to broaden the technical focus on standards that has existed in prior IS research and to also equally emphasize the challenges of standardizing management practices and processes, which are often more difficult to implement than the technical standards. The need then is to take the technical and social issues in conjunction when trying to address the challenges of both scaling and standardizing. This thinking is in line with the II perspective drawn upon in this thesis to treat the II as a complex and socio-technical heterogeneous network.

Another issue that has been emphasized in the research on standardizing has been on the need to find a "pragmatic balance" between being sensitive to the requirements of the local context with the demands of creating standardized solutions where one "size fits all". The need for such a balance has been expressed by authors in different ways such as "flexible standards" (Hanseth and Monterio, 1998), the "third way" or "flexible standards" (Braa *et al* 2005), "hierarchy of standards" (Braa and Hedberg 2002) and "local universalities" (Berg and Timmermans, 1997). For example, drawing from an ongoing case study in a Maritime Classification Company (MCC) based in Norway, Rolland and Monteiro (2002) have explained the significance of standards in a globally spread institution like the MCC while giving the possibility for the local organization to perform their own tasks. Similarly, research in the health domain has emphasized the

need for flexible standards that support HII activities across both the horizontal (across facilities at the same level) and vertical (across different levels of the health hierarchy such as health facilities, weredas, province and federal) levels (Braa and Hedberg, 2002). They propose, as discussed earlier, the principle of a hierarchy of standards where each level, while catering to the needs of the next higher level of the hierarchy, has the potential to add or delete standards (like data elements) based on their local needs.

Most research in IS, especially within the health structure, have focused on the challenges of scaling or standardizing independently, and have not explicitly analyzed the interrelation of these concepts, and how they influence each other. Through our research, we argue that there is a need to explicitly look at the interrelationship of these concepts, as they are fundamentally related. Furthermore, we argue that there are dilemmas associated in their relationship as each can both support and undermine the other. We identify three sets of dilemmas: how standardizing can support (or not) the scaling efforts; how scaling can support (or not) the standardizing effort; and the political implications of scaling standardized solutions.

***How standardizing can support (or not) the scaling efforts***: The research was initiated first in Addis Ababa region. Through a participatory process, as described in the case study, standards were created around the data sets, reporting formats, and also the DHIS (for example, the computerized implementation of the reports). As discussed earlier, we were not successful in the standardizing of the work practices. The standardizing process achieved in Addis (around data sets and software) facilitated the scaling process in Oromia region, since basic parts of the database, the data sets and the reporting systems could be used as the point of departure in Oromia and be reused and adapted. As a result, we did not have to completely reinvent the wheel. However, this process also had its disadvantages, especially in being able to identify and deal with the local needs in Oromia. For example, Oromia region, because of the high incidence of Malaria, had very specific requirements about collecting and reporting data about malaria. However, initially we did not consider it as being very important, which is something we learnt

from our case study in Addis. In addition, we also overlooked the importance of the environmental health data collection and reporting, which was not the responsibility of the Addis Ababa RHB. Accordingly, we designed the reporting formats and the DHIS software without including these data elements which influenced our acceptance in Oromia region where these data have significance for managerial decision making purposes.

As a result, we can see that while the standards developed in one region when taken to another can support the scaling processes, but they also can mask some of the local particularities that in the longer run can also inhibit the scaling efforts.

***How scaling can support (or not) the standardizing efforts***: In a simple term, scaling refers to increasing the number of users to adopt a certain standard or increasing the functionality to be adopted by large group of users. Our standardizing process was seen to be facilitated when the number of users who adopted the standardized data set, data collecting instrument and software system was increased. For example, it was easier for us to start the standardizing process in Amhara region as compared to the efforts we made in Oromia region. In addition to the expansion in the number of users, the standardizing process was also seen to be facilitated when the DHIS increased in functionality. For instance, standardizing DHIS was much easier in Oromia region as its functionality was already increased to accommodate the MM data. The absence of this functionality was a major challenge to create a standardized technical system in Addis. However, as this major requirement in the country was included in the system, we found standardizing the computer system in Oromia region less challenging.

We relate the above issue with the notion of 'network externalities' (Katz and Shapiro, 1996) where the term refers the increase in the benefit that an agent derives from a good when the number of other agents consuming the same kind of good increases. When it is applied to our case, the good refers to the various standards and the agent refers to the RHBs who were to receive the benefits through adoption of the standards. For example,

the benefits to Amhara region was increased since the standardized data set, data collecting instruments and the software system were already adapted for Addis and Oromia region, and Amhara's requirements were to a large extent already met. Furthermore, there is a general tendency of accepting standards which are already adopted by large group of people. In general, in our case study, we were able to observe the enabling factor of scaling on standardizing. On the other hand, as the number of users expand, building consensus amongst the heterogeneous actor on what should be the shared standards becomes difficult due to the diversity of interests. Hence, the expansion in the number of users was also found to be a constraining factor to the standardizing process.

***The political implications of scaling standardized solutions***: Having succeeded in Addis at first gave us a "political" advantage, since Addis was the capital city of the country, and seen to be closer to the federal level. However, taking the standard data set and reporting formats of Addis could also be seen to contribute to a "lock in" effect for the users of the Oromia region, which had a constraining influence on the scaling process. Users in Oromia region were biased to keep all the information collected by the capital city despite some of the data not having direct importance for them. This is related to the 'nice to know' rather than "essential to know" approach that we have discussed in the previous sections. Also, some people could think that using the Addis standards as the point of departure in Oromia to represent an imposition from the capital, and thus something that should be resisted.

Therefore, on the one hand, the availability of standards served as a point of departure and thus was an enabling factor to the scaling process, but on the other hand, these standards also constrained the scaling process by affecting the ability and potential of the users to independently choose what was important for them. In addition, the scaling process facilitated the standardizing process as users can benefit and tends to adopt a standard which was already being adopted by a large group of people, on the other hand as the diversification of interests increases with the scaling of the number of users.

Building a consensus to create standards becomes difficult and hence constraints the standardizing effort. The political symbolism associated with using standards developed in one region, also had implications on the scaling process to other regions.

In summary, we argue that the processes of scaling and standardizing would be better understood if they are viewed in conjunction with each other, rather than being conceptualized independently. While in our particular context, we have identified three sets of dilemmas, however, in other contexts there may be other dilemmas, and may be aspects of standardizing which have a negative influence on scaling in our case could actually contribute to positive influences elsewhere. The example of Braa and Hedberg (2002) emphasizes how the success achieved in the Eastern Cape Province in South Africa, because of the political visibility assigned to this success helped the scaling process to other provinces in the country. This then is an example of how the political symbolism of achieving standards in one case contributes to the scaling efforts in other cases. When contrasting this example with our case, the political symbolism had mixed effects which emphasizes that while we need to look at standards and scaling together, the socio-political context will mediate the relationship differently in varying settings.

In this chapter, we have presented the analysis and discussion of the research which we described in the methods chapter (3) to represent the 'specifying learning' phase of the action research life cycle. Our main emphasis was to analyze and discuss the challenges and approaches of scaling and standardizing processes in the two regions (Addis Ababa and Oromia) building up on the broader perspective of II. Two concepts; installed base and cultivation, were used as they were relevant to analyze the empirical material. The historically existing and socially and politically constructed installed base of the data sets, data collecting instruments, software system and work practices provided the inertial influences to the new standardizing process as well as for the horizontal and vertical scaling efforts. We also raised three dilemmas associated with the interrelation of these concepts; which was on one hand enabling, and on the other hand constraining the two sets of processes. In the next chapter, we provide the conclusions of the research and

identify some further research insights that we believe should be dealt in future research endeavors.

# 8 CONCLUSIONS

## 8.1 Introduction

In this chapter, we present some brief conclusions arising from this study with respect to our research objectives, and to identify some further areas of research. Accordingly, in the first section, we present some concluding remarks which summarise some key research issues and implications, both theoretically and practically. Following which, in the next section, we identify some areas of further research.

## 8.2 Concluding remarks

*This thesis started with two objectives of 1) To understand the nature of the challenges of scaling and standardizing in the context of HIS in developing countries more broadly, and in Ethiopia in particular, and, 2) To explore the particular approaches and strategies used to address these challenges, specifically within the context of the health sector in Ethiopia.*

Through our empirical work in the two regions of Ethiopia; Addis Ababa and Oromia, the following challenges to the standardizing process were identified. These are; 1) lack of national level involvement 2) poor culture of information use 3) inadequate public health inputs in the HISP team; 4) time and logistics constraints; 5) large geographical size (peculiar to Oromia) and, contextual differences in the health systems. In discussing these challenges, we identified standardizing as a process rather than a one shot event, and should not be treated as merely a technical exercise (of protocols and software) but as a socio-technical and heterogeneous process. With this perspective, we identified the key elements comprising the scope of standardizing to include data sets, data collecting instruments, software system and the work practices. Our empirical work emphasized that

while it is easier to implement the technical standards such as of data sets, data collecting instruments, and software systems, it is much harder to do so for work practices as these are historically and socially embedded in the context.

With respect to the process of scaling, we identified the following set of four key challenges: 1) uneven infrastructure development; 2) varying management commitment; 3) the presence of legacy IS; 3) large geographical size; and, 4) differences in organizational structure and functional requirements. The challenges were experienced in spreading and scaling the standardized data sets and the data collecting instruments and the software system both horizontally and vertically. We found scaling to be a complex and heterogeneous process as has also been argued in prior IS research (for example, Sahay and Walsham 2005). The complex challenges brought about different stages of geographic and functional coverage in the two regions. In Addis, the scaling process went up to the health facilities while in Oromia the process has been confined to one zone. This poor scaling contributed to the health managers being less motivated to our efforts as they could not get full coverage data which they required for supporting their everyday functional actions.

The challenges were theoretically analyzed using concepts from II theory, specifically installed base and cultivation. As a point of departure of our conclusions as compared to prior IS research on these topics, our analysis has helped to emphasize that scaling and standardizing should not be seen as independent elements but in relation with each other. However, the relation between them cannot be seen in a linear form, but are shaped and mediated by the particularities of the social and political context. As a result, there are dilemmas associated with this relationship where one can both support and also undermine the other. We have, through our analysis, identified the following three major dilemmas; how standardizing can support (or not) the scaling efforts, how scaling can support (or not) the standardizing efforts, and, the political implications of scaling standardized solutions.

While our analysis has been developed based on empirical work carried out in two regions of Ethiopia, we believe that the study has broader implications for other regions in Ethiopia and also for other developing countries. For example, a general implication from our study is to examine scaling and standardizing as interconnected aspects. While the nature of the dilemma itself might be different in varying contexts, but the analytical concept of a dilemma is useful to understand the challenges.

Our study also makes a number of important practical contributions, as is the objective of an action research study such as ours. This research has contributed to the client organization (the RHBs) in a number of different ways in terms of improving the existing HII. We have made available the DHIS software through a process of adaptation and implementation, and currently, Addis Ababa and one zone of the Oromia region are using the new system for data entry, processing and reporting activities. We have also helped to develop a set of standards for data, which have been implemented in both regions. However, as we have pointed out earlier, the achieved standardizing process is a first step in a larger process which requires further extension and refinement. Moreover, we have designed a uniform data collection format to try and overcome the un-standardised and fragmented data collection formats, and these are being used in both the regions.

Recently, the HISP Ethiopia team has signed MOUs with the two regions under our study, as well as with other three more regions (Tigray, Amhara and Benshangul Gumuz) which were also HISP pilot regions from the beginning. Five of the new graduate HISP members (including the two of us) are employed through European Union funding to be responsible for the next phase of the action research iteration. Therefore, this research is believed to provide a base for further scaling (geographical and functional) and standardizing processes in the regions already studied and also to other regions.

Our research has also contributed in some ways to the infrastructure development in the regions. Due to the implementation of DHIS in the two regions, some weredas/sub-cities, and health facilities have made arguments for and received computers that can be seen as contributing to them becoming more active members of the "network society". As a part of the scaling process, negotiations with non governmental organization (e.g. CDC) to get computers for the most deprived regions of Ethiopia like Benshagual-Gumz has also been made, and approved.

The DHIS training conducted by us has enabled a number of the health staff to acquire computer knowledge that they can use for data processing activities. This skill was not present before, and using this can also provide the potential for them to use the computer for other tasks (like making personal budgets, writing leave letters etc). This enhanced level of skills can arguably said to have contributed to the overall capacity development of the HII in the two regions. From the HISP side, the training sessions have practically contributed to the preparation of training manuals that can be used in other regions and to develop the capacity of support staff employed by HISP to facilitate the implementation work.

Like all studies, ours also has its limitations which are worth mentioning. The first limitation was our inability to standardise the inconsistent work practices that we believe has significant importance to improve the overall HII. As a second limitation, the coverage issue in Oromia could be raised. Because of the time and organizational constraints, as discussed in chapter 7, our work could not proceed from the pilot zone (East Shoa). This, we believe, made the ORHB staff to be less motivated to our work as they did not get meaningful data from all the zones. The third limitation of the research was its minimal focus on the federal level (MOH) because of which we could not integrate the reporting formats which were originating from this level, and, hence, we could not achieve 'ideal' standards.

## 8.3 Future research areas

During the fieldwork, we were able to observe the impossibility of developing a huge, monolithic and universal standards which could serve as a solution for all the HIS related problems in the health care sector. For example, our findings demonstrated that even if a system could be implemented for the routine data collection and reporting, the patient record system still remains unchanged and needs to be improved to help strengthen the overall HIS. In addition, users are now requesting for additional functionalities such as personnel, pharmacy and financial data bases that would need to be developed and integrated with the DHIS software in the future. Integrating the various kinds of HIS thus is a key challenge in the future, both in theoretical and practical terms. The suggestion here would be to focus on improving 'parts' of the system through integration so as to strengthen the 'whole' system, rather than trying to radically change the whole system at once. Such a quest for radical change is impossible due to the complexity that is inherent in the HII due to both technical and institutional reasons. Therefore, we emphasize the need to focus on identifying strategies of integration and how these could contribute to both scaling and standardizing processes analyzed in an interconnected manner.

However, in attempting this, we advise the need to look at the inherent dilemmas associated with scaling and standardizing. As discussed above, we identified three sets of dilemmas in the context of Ethiopia broadly and in the context of the two regions specifically. We believe that there will be other dilemmas related to these concepts in other contexts. Identifying these dilemmas would help to contribute to IS research engaged in finding approaches to successfully implement HII in the context of developing countries. Therefore, we emphasize the need for further IS research to engage with the research topic of 'dilemmas of scaling and standardizing' in both theoretical and practical terms in future research.

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# APPENDICES

## Appendix A. Interview Guide

| |
|---|
| For sub-city and health facility statisticians (to study the current his situation) |
| What is your position and educational level? |
| How is your responsibility in collecting, analyzing and preparing routine monthly report? |
| Do you get monthly reports from facilities/departments on time? |
| Do you have shortage of data collection format? |
| What do you use to prepare monthly reports? |
| Do you have any problem to send reports data to upper level? |
| How do you store the monthly reports? |
| For what purpose/s do you use the collected data? |
| Do you get feed back from the region/sub-city based on the report what you send monthly? |
| How do you send the routine monthly data to the region/sub-city? |
| For whom do you send the routine monthly report? |
| How do you validate the correctness of the data that you are receiving monthly? |
| For which institutions do you send reports out of the health care system? |
| Are there computers, printers and telephone in your health facility/sub-city health department ad where are they placed? |
| Do you have basic computer skill? |
| For Sub-city and health facility statisticians(to evaluate the DHIS training and the new reporting format) |
| How do you get the computer basics and DHIS trainings? How do you see the training time/duration? |
| Do you have any treat to prepare the routine monthly report by using the DHIS software? |
| Does the currently revised data collection form enable you to collect all data that you want to be collected? |
| are all the health facilities send reports by the standard data collection format? |
| Sub-city Health Department managers (to study the changes that are brought by the new system) |

| |
|---|
| For what activities do you use the data which are collected from the health facilities? |
| Do you think that DHIS has supported you to accomplish the above mentioned activities? If yes, how? If No, can you please explain why it is not supporting? |
| What problems did you observe in the manual system?(before the implementation of DHIS) |
| Which of the problems are solved by the implementation of the computerized health information system? |
| What changes haven you seen in the health information system after the implementation of DHIS? |
| Did you face any challenge because of DHIS? |
| If you have any other comment or suggestion on the system? |
| Which indicators are appropriate at this level? |

**Appendix B. Questionnaire**

1. Wereda Name_____Rura/Urban_____

Department_____

2. Education level?

a. High School Complete b. Certificate c. Diploma e. Degree

3. Do you get monthly report from health facility on time?

a. Yes b. No

4. If your answer is "NO" for the above question what do you think the problem?

a. Transportation Problem b. Roads are not good c. Absence of dedicated person

d. Time constraint e. Other please specify_____

5. Are the existing data collection formats adequate to collect the required information?

a. Yes b. NO

6. Are the data collecting formats uniform or standard in your health facility/ wereda/zone?

a. Yes b. NO

7. Do you have shortage of data collecting and reporting formats?

a. Yes b. NO

8. Which of the following tool do you use to prepare monthly report?

a. Manually b. Calculator

c. Computer d. Other Please specify_____

9. How do you store the routine monthly data and report?

a. Paper b. Computer c. Other please specify

10. For what purpose do you use the monthly report?

a. To send to upper level b. Use for planning

c. Other please specify_____

11. Do you get feed back from upper level?

a. Yes b. No

12. How do you send the routine monthly report to the next level?

a. I take it my self b. Messenger

c. Person who goes to zone d. Through Postal office

e. Other please specify_____

13. Have you ever got training regarding information handling and use?

a. Yes b. NO

**Computer Related**

14. Does your wereda have Electricity?

a. Yes b. No

15. Which of the following ICT facilities do you have in your wereda?

a. Computer b. Printer c. Telephone

d. Fax. E. Scanner f. Other _____

16. For what purpose do you use the computers?

a. Secretarial work b. Data processing

c. Spreadsheets e. Other please specify_____

17. Do you have computer training previously?

a. No b. Yes

**Evaluation of the training**

18. How did you get the DHIS training that was organized by HISP and ORHB?

a. Bad b. Well c. Good d. Very good

19. How do you get the training time/duration?

a. Adequate b. Short c. Very short d. Other___

20. How is the DHIS manual?

a. Simple and Clear b. Difficult to understand

c. Well d. Other Please Specify

21. Do you have any threat to use the DHIS software for the routine monthly report?

a. Absence of computer b. The training is not enough

c. Lack of support d. Other please specify___

## Appendix C Training proposal

From : HISP-Ethiopia

To : Oromia Planning Department

Date : 04 August 2004

Subject : District Health Information System Software Training

Oromia Health Bureau and HISP-Ethiopia have started to improve the health management information system in the Eastern Shoa Zone of Oromia. As we have decided to begin the implementation in July 27, 2004 meeting. HISP has made informal meeting with Eastern Shoa zone health desk head and planning team person to arrange training for the pilot users. We have discussed on different issues including infrastructure, the availability of IT resources at wereda level that helped us to select trainees. Based on the information that we have collected, we propose potential trainees, type of the course, duration of the training, the schedule and the required resources as follows.

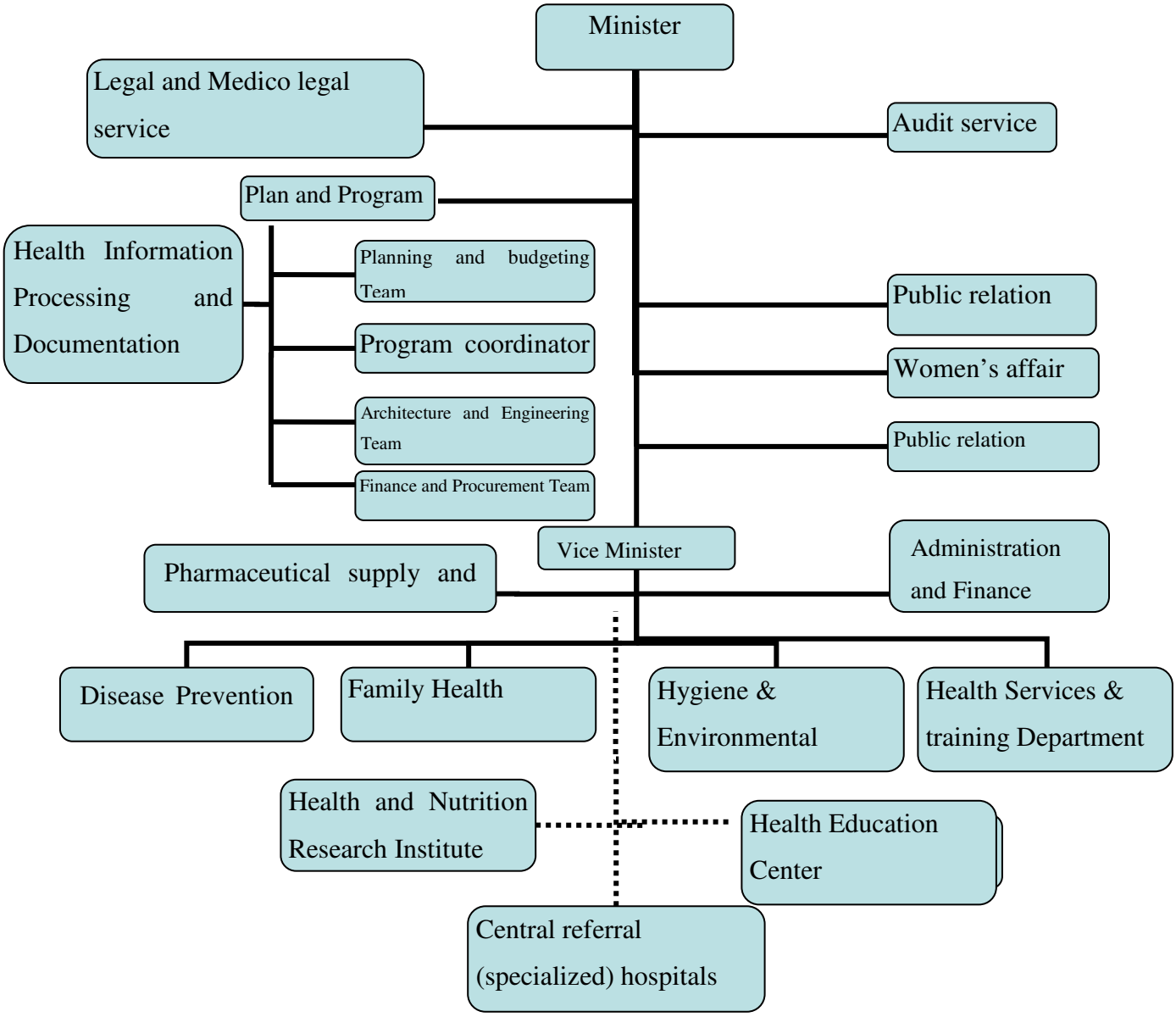
| s.no | Course Type | Schedule | Trainees | Duration |
|---|---|---|---|---|
| 1 | Computer Basics | 3/12/96 – 7/12/96 | 30 wereda + zone | 1 week |
| 2 | DHIS | 10/12/96 – 14/12/96 | The above trainees + 5 staff ORHB | 1 week |
| 3 | Special Training(comp. Basics + DHIS Report) | 17/12/96 – 21/12/96 | 14 Wereda Heads<br>5 Dept. Heads from ORHB | 1 week |

### Trainees

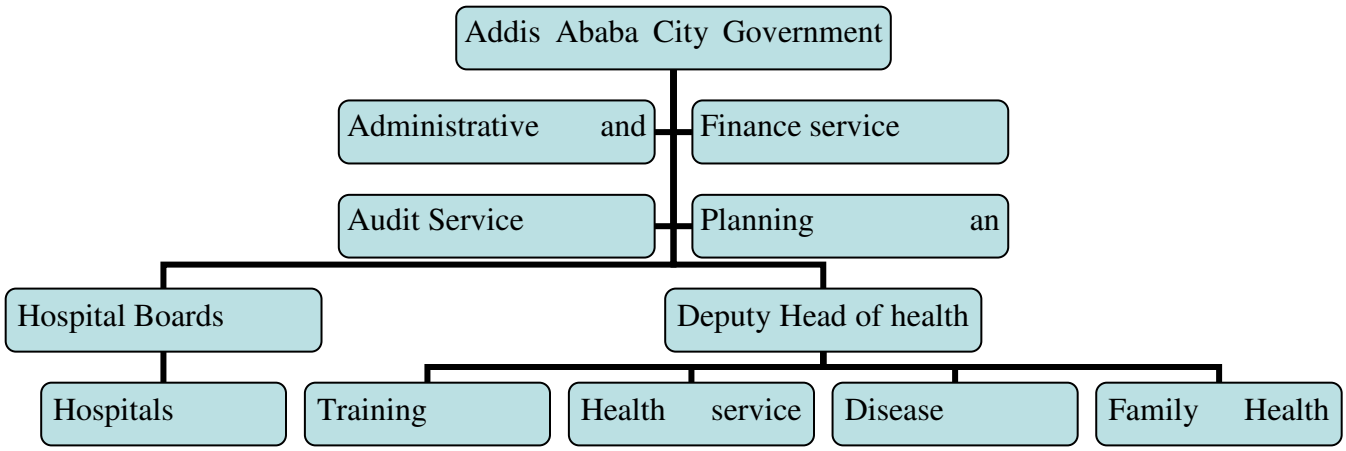
Two trainees will be selected from each woreda health office those who are working directly in health information system for full training (28); Two trainees from zone planning department; Five trainees from; Head Office who are directly working in HMIS; Five trainees from Head Office; concerned department heads and section head for special training; 14 trainees from woreda health office department head for special training. Required Resource for training; 20 computers if it is possible, LCD Projector and white board if it is possible

## Appendix D: Organizational structure

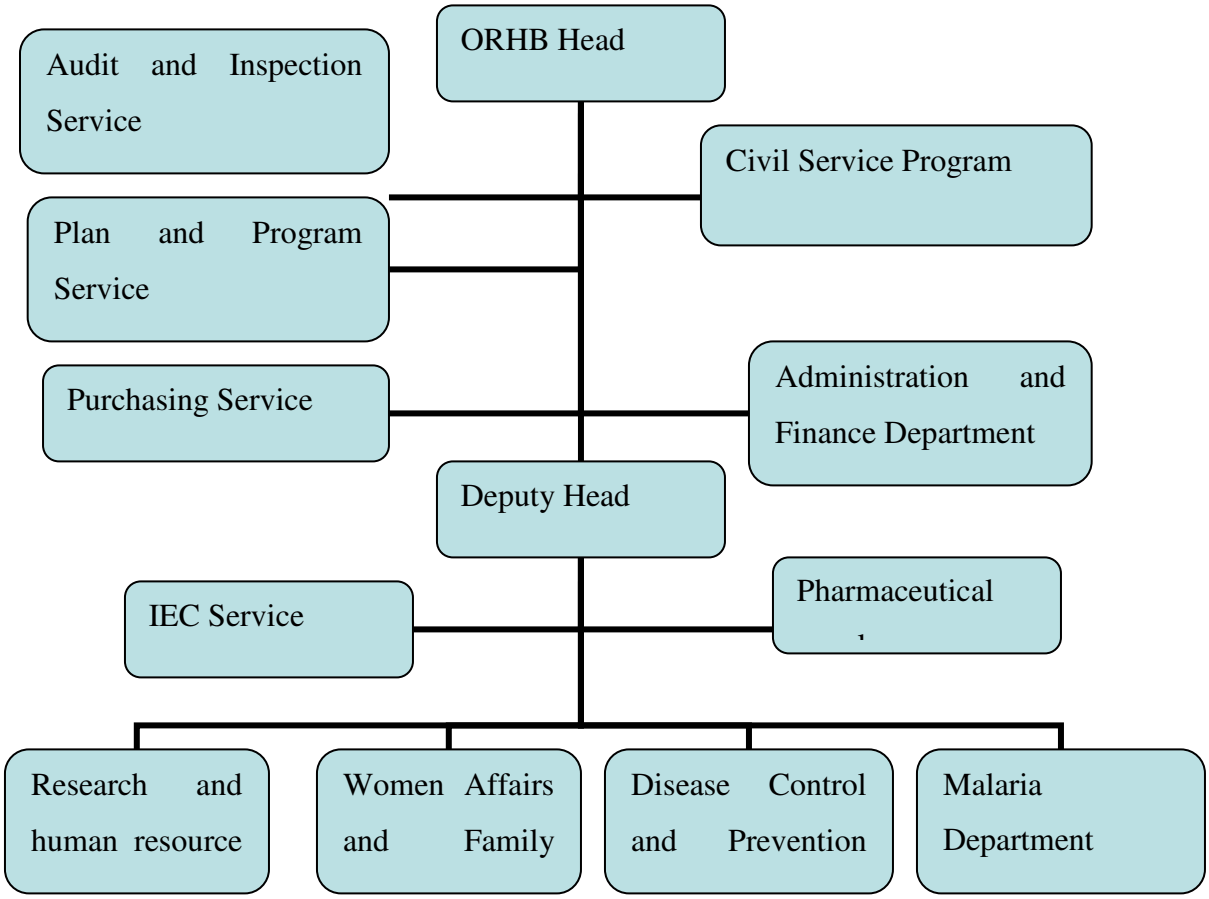
### D.1 Organizational structure of MOH



### D.2 Organizational structure of AACGHB




### D.3. Organizational Structure of ORHB



## Appendix E. Data collection formats

## E.1 IMCI reporting format

1st Quarter Report
TOTAL Of the region

July 2004-Sep2004 three month of IMCI Report

| TYPE OF DISEASE | CLASSIFICATION | UNDER 2 MONTH | | | 2-59 MONTH | | | G.TOTAL | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | INITIAL | F/UP | REFERR | INITIAL | F/UP | REFERR | INITIAL | F/UP | REFERR |
| | Posible SERIOUS B.INF | 176 | 19 | 113 | | | | 176 | 19 | 113 |
| | LOCAL B. INF | 249 | 56 | 12 | | | | 249 | 56 | 12 |
| BACTERIAL INFECTION | TOTAL | 425 | 75 | 125 | 0 | 0 | 0 | 425 | 75 | 125 |
| | S.PNEMOUIA | | | | 433 | 29 | 311 | 433 | 29 | 311 |
| | PNEMOUNIA | | | | 8759 | 2242 | 21 | 8759 | 2242 | 21 |
| | NO PNEMONIA | | | | 7253 | 1211 | 22 | 7253 | 1211 | 22 |
| ARI | TOTAL | 0 | 0 | 0 | 16445 | 3482 | 354 | 16445 | 3482 | 354 |
| | S.DEHYDRATION | 296 | 60 | 9 | 31 | 2 | 21 | 327 | 62 | 30 |
| | SOME DEHYDRATION | 23 | 2 | 0 | 220 | 59 | 3 | 243 | 61 | 3 |
| | NO DEHYDRATION | 127 | 19 | 0 | 5813 | 879 | 0 | 5940 | 898 | 0 |
| | SEVERE PERSISTENT DIARRHEA | 5 | 0 | 0 | 9 | 0 | 4 | 14 | 0 | 4 |
| | PERSISTENT DIARRHEA | | | | 84 | 19 | 2 | 84 | 19 | 2 |
| | DYSENTERY | 1 | 0 | 1 | 616 | 89 | 14 | 617 | 89 | 15 |
| DIARRHEA | TOTAL | 452 | 81 | 10 | 6773 | 1048 | 44 | 7225 | 1129 | 54 |
| | V.SEVERE FEBRIL DISEAS | | | | 338 | 25 | 22 | 338 | 25 | 22 |
| | MALARIA | | | | 188 | 10 | 2 | 188 | 10 | 2 |
| | NO MA/FEVER MAL UNLIKELY | | | | 4814 | 236 | 1 | 4814 | 236 | 1 |
| FEVER | TOTAL | 0 | 0 | 0 | 5340 | 271 | 25 | 5340 | 271 | 25 |
| | COMPLICATED MEASLES | | | | 1 | 0 | 0 | 1 | 0 | 0 |
| | MEASLESWITH EAY&EAR INF | | | | 6 | 0 | 2 | 6 | 0 | 2 |
| | MEASLES | | | | 16 | 1 | 0 | 16 | 1 | 0 |
| MEASLES | TOTAL | 0 | 0 | 0 | 23 | 1 | 2 | 23 | 1 | 2 |
| | MASTODITIES | | | | 49 | 1 | 5 | 49 | 1 | 5 |
| | ACUT EAR INFECTION | | | | 1335 | 225 | 1 | 1335 | 225 | 1 |
| | CHRONIC EAR INFECTION | | | | 194 | 284 | 14 | 194 | 284 | 14 |
| EAR INFECTION | TOTAL | 0 | 0 | 0 | 1578 | 510 | 20 | 1578 | 510 | 20 |
| | NOT ABEL TO FEED | 44 | 9 | 6 | | | | 44 | 9 | 6 |
| | FEEDING PROBLEM | 126 | 19 | 0 | | | | 126 | 19 | 0 |
| | LOW WEIGHT | 46 | 11 | 6 | | | | 46 | 11 | 6 |
| | NO FEEDING PROBLEM | 469 | 8 | 0 | | | | 469 | 8 | 0 |
| | SEVERE MALNUTRITION | | | | 132 | 32 | 59 | 132 | 32 | 59 |
| | SEVER ANEMIA | | | | 43 | 3 | 21 | 43 | 3 | 21 |
| | ANEMIA | | | | 143 | 39 | 14 | 143 | 39 | 14 |
| | VERY LOW WEIGHT | | | | 1086 | 196 | 25 | 1086 | 196 | 25 |
| | NOT VERY LOW WEIGHT | | | | 22029 | 707 | 0 | 22029 | 707 | 0 |
| | GROWTH FLATERING | | | | 3871 | 20 | 1 | 3871 | 20 | 1 |
| NUTRITIONAL PROBLEM | TOTAL | 685 | 47 | 12 | 27304 | 997 | 120 | 27989 | 1044 | 132 |
| OTHERS | | 1430 | 37 | 25 | 8891 | 490 | 160 | 10321 | 527 | 185 |
| TOTAL CHILDREN SEEN | G.TOTAL | 2992 | 240 | 172 | 66354 | 6799 | 725 | 69346 | 7039 | 897 |

## E.2 EPI reporting format designed on the excel spread sheet

ADDIS ABABA CITY ADMINISTRATION HEALTH BUREAU

Tabel 1 :shows 1st Quarter report of 1996 EFY

E.P.I VACCINATION

| Sub-City | No of | | | | | | DPT | | | | | | OPV | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | vacination | | BCG | | measels | | 1 | | 2 | | 3 | | 0 | 1 | | 2 | | 3 | | |
| | stat | out-r | 0-11 | 12t2 | 0-11 | 12to 2 | 0-11 | 12t | 0-11 | 12t | 0-11 | 12t | 0-11 | 11 | 0-11 | 12t | 0-11 | 12 | 0-11 | 12t |
| Arada | 7 | 0 | 1353 | | 953 | 0 | 1043 | 0 | 1056 | 1 | 1049 | 0 | 1245 | | 1043 | 0 | 1056 | 1 | 1049 | 0 |
| Adiis Ketema | 5 | 8 | 654 | 0 | 606 | 0 | 782 | 0 | 754 | 0 | 763 | 0 | 478 | | 782 | 0 | 754 | 0 | 763 | 0 |
| Lideta | 8 | 0 | 1554 | 0 | 1391 | 0 | 1564 | 0 | 1489 | 0 | 1489 | 0 | 1201 | | 1564 | 0 | 1489 | 0 | 1489 | 0 |
| Kirkos | 10 | 0 | 2310 | 0 | 976 | 16 | 1146 | 0 | 1057 | 0 | 1068 | 0 | 2217 | | 1146 | 0 | 1057 | 0 | 1068 | 0 |
| Yeka | 6 | 8 | 1236 | 6 | 1314 | 0 | 1651 | 0 | 1665 | 0 | 1643 | 0 | 1029 | | 1651 | 0 | 1665 | 0 | 1643 | 0 |
| Bole | 8 | 8 | 1030 | 0 | 875 | 0 | 1099 | 0 | 1092 | 0 | 1123 | 0 | 665 | | 1099 | 0 | 1092 | 0 | 1123 | 0 |
| Akaki-Kality | 2 | 10 | 564 | 4 | 482 | 5 | 609 | 3 | 575 | 1 | 563 | 3 | 382 | | 609 | 3 | 575 | 1 | 563 | 3 |
| Nifas silk-Lafto | 5 | 9 | 1214 | 11 | 1194 | 2 | 1348 | 9 | 1335 | 0 | 1401 | 0 | 868 | | 1348 | 9 | 1335 | 0 | 1401 | 0 |
| Kolfe-keranio | 6 | 7 | 1304 | 0 | 1235 | 0 | 1461 | 0 | 1500 | 0 | 1492 | 0 | 816 | | 1461 | 0 | 1500 | 0 | 1492 | 0 |
| Gulele | 3 | 7 | 864 | 0 | 677 | 0 | 930 | 1 | 949 | 0 | 914 | 0 | 586 | | 930 | 1 | 949 | 0 | 914 | 0 |
| G.total | 60 | 57 | 12083 | 21 | 9703 | 23 | 11633 | 13 | 11472 | 2 | 11505 | 3 | 9487 | | 11633 | 13 | 11472 | 2 | 11505 | 3 |

### E.3. Inpatient morbidity and mortality report

| ICD code | Male age (in years) | | | | | | | Female age (in years) | | | | | | | Total male & female | TLS | | Condition on discharge | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | cured | | improved | | no improvement | | worse | | dead | |
| | <1 | 1-4 | 5-14 | 15-44 | 45-64 | 65+ | total | <1 | 1-4 | 5-14 | 15-44 | 45-64 | 65+ | total | | m | f | M | f | m | f | m | f | m | f | M | f |
| 001 | | | | | | | | | | | | | | | | | | | | | | | | | | | |

### E.4 TT vaccination reporting format

### Old reporting format

**8.2. TT Vaccination**

| Zone/ Special Wereda | TT for Pregnant | | TT for Non Pregnant | |
|---|---|---|---|---|
| | $TT_1$ | $TT^{+}_2$ | $TT_1$ | $TT^{+}_2$ |
| KOFE Health center | 2250 | 3572 | 109 | 193 |
| Gefferisa Red cross HS | 252 | 168 | 27 | 48 |
| W 23 K16 HS | 110 | 403 | 56 | 64 |
| W 24 K 15 HP | 263 | 136 | 85 | 169 |
| W G05 K 16 HP | — | — | — | — |
| Mary Joy HC | 256 | 299 | — | — |
| SOS Keranio HS | 201 | 290 | 208 | 221 |
| Awolia HC | 539 | 690 | — | — |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Total | 3871 | 5158 | 477 | 722 |

## New reporting format

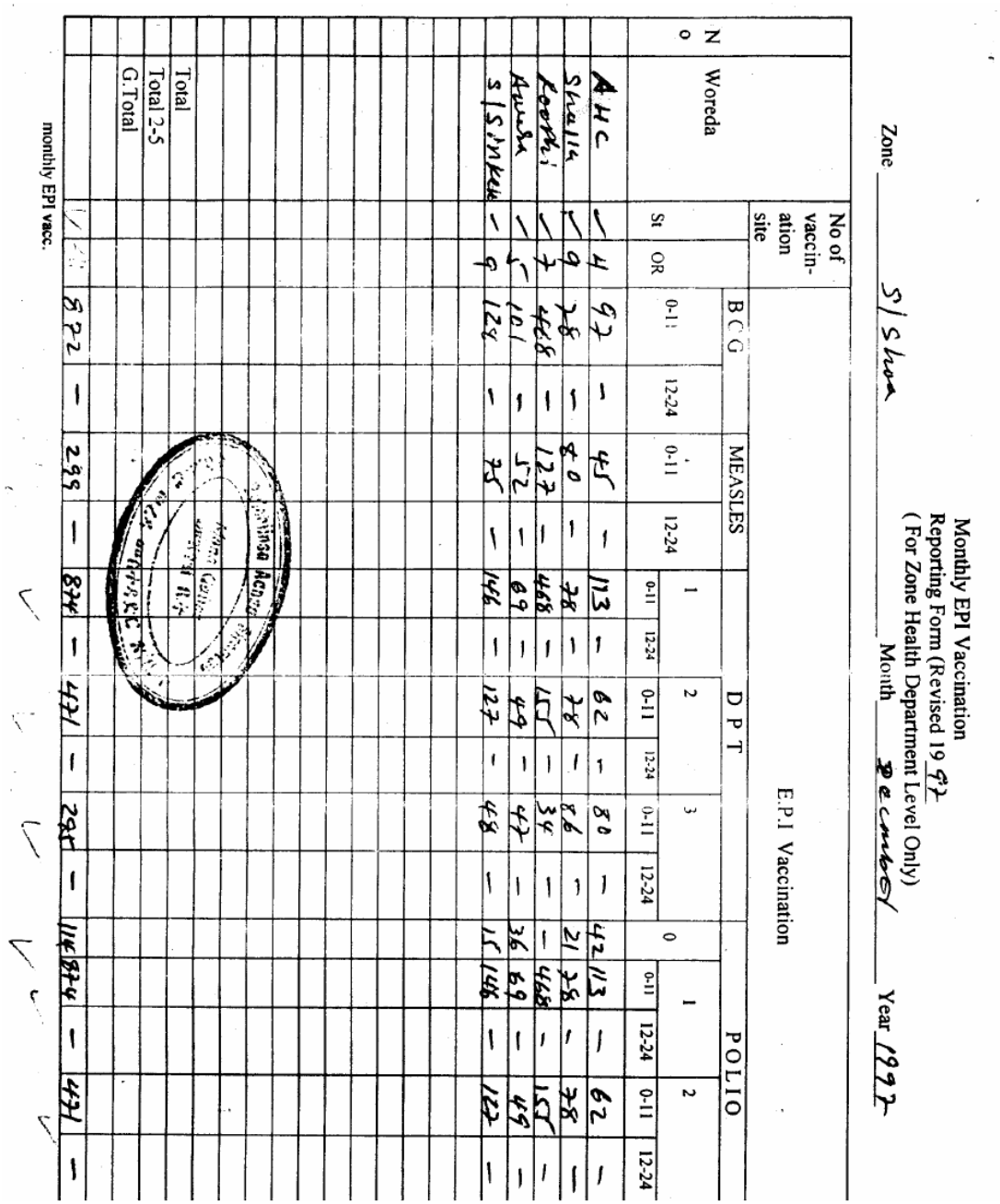
| 1.2.4 TT Vaccination | | | | | |
|---|---|---|---|---|---|
| | Pregnant Women | TT 1 | | | |
| | | TT 2 | | | |
| | | TT 3 | | | |
| | | TT 4 | | | |
| | | TT 5 | | | |
| | | TT 2+ | | | |
| | Non-pregnant women | TT 1 | | | |
| | | TT 2 | | | |
| | | TT 3 | | | |
| | | TT 4 | | | |
| | | TT 5 | | | |
| | | TT 2+ | | | |

## E.5 Performance coverage reporting format

ZEWDITU MEMORIAL HOSPITAL MONTHLY REPORT from Tekemet / Oct. 1- 30 / 1997 Eth.Cal

| SR. NO. | ACTIVITIY | ANNUAL PLAN 1997 | QUARTERLY PLAN 1997 | MONTHELY PLAN 1997 | MONTHELY PERFORMANC Tekemet1- 30 / 1997 | % | Total | M | F | REMARK |
|---|---|---|---|---|---|---|---|---|---|---|
| 8.5 | HIV / AIDS Total | 12000 | 3000 | 1000 | 406 | 40.6 | 592 | 260 | 332 | |
| | New | 4000 | 1000 | 333 | 105 | 31.53 | 161 | 75 | 86 | |
| | Repeat | 8000 | 2000 | 667 | 301 | 45.13 | 431 | 185 | 246 | |
| 9 | T.B.Clinic | 13000 | 3250 | 1083 | 592 | 54.66 | | | | |
| | New Out Patients | | | | | | | | | |
| | Repeat Out Patients | | | | | | | | | |
| | ART Total | | | | | | 1960 | | | |
| | New Out Patients | | | | | | 142 | | | |
| | Repeat Out Patients | | | | | | 1818 | | | |
| | Pediatrics APPC Total | 2000 | 500 | 167 | 197 | 118 | 197 | 67 | 130 | |
| | New | 1100 | 275 | 92 | | | 131 | 26 | 105 | |
| | Repeat | 900 | 225 | 75 | | | 66 | 41 | 25 | |
| 10 | Physiotherapy | 11100 | 2775 | 925 | | 84.32 | 780 | | | |
| | Out- Patients | | | | | | 752 | | | |
| | In- Patients | | | | | | 28 | | | |
| 11 | Other Activities | | | | | | | | | |
| 11.1 | Health Education | | | | | | | | | |
| 11.2 | OPD Injection | | | | | | | | | |
| 11.3 | OPD Dressing | | | | | | | | | |
| 11.4 | Medical Check up | | | | | | | | | |
| 11.4.1 | For Driving Licence | | | | | | | | | |
| 11.4.2 | For Employment | | | | | | | | | |
| 11.4.3 | For Medical Boord | | | | | | | | | |
| | SCHOLAR SHIP | | | | | | | | | |

## E.6 EPI Reporting format by age wise break down



Monthly EPI Vaccination
Reporting Form (Revised 19 97
( For Zone Health Department Level Only)

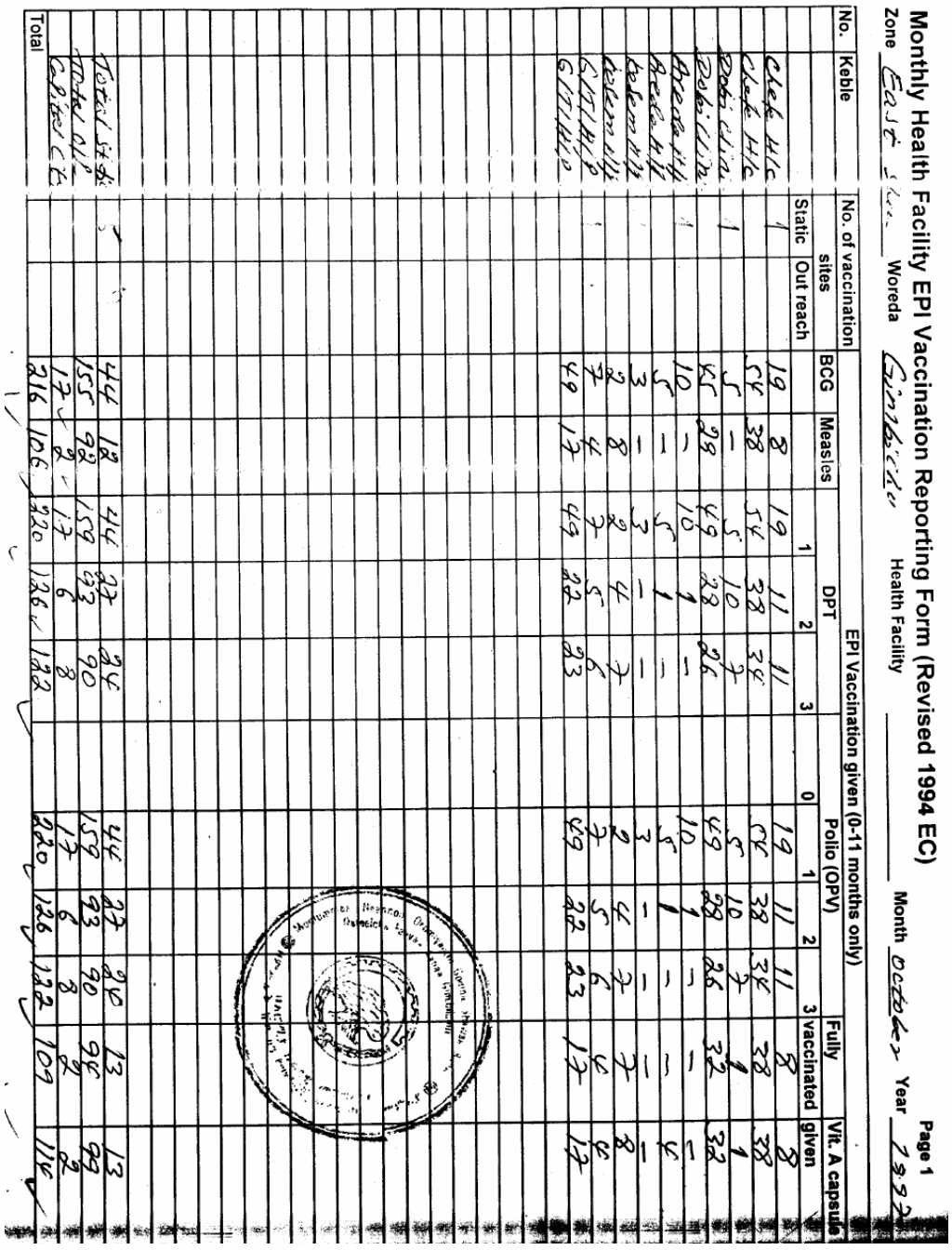
Zone S/Shan Month December Year 1997

E.P.I Vaccination

| No | Woreda | No of vaccination site | | BCG | | MEASLES | | DPT 1 | | DPT 2 | | DPT 3 | | POLIO 0 | | POLIO 1 | | POLIO 2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | St | OR | 0-11 | 12-24 | 0-11 | 12-24 | 0-11 | 12-24 | 0-11 | 12-24 | 0-11 | 12-24 | 0-11 | 12-24 | 0-11 | 12-24 | 0-11 | 12-24 |
| | AHC | 4 | 9 | 97 | - | 45 | - | 113 | - | 62 | - | 80 | - | 42 | 113 | - | 62 | - | - |
| | Shella | 9 | 2 | 28 | - | 80 | - | 28 | - | 28 | - | 26 | - | 21 | 28 | - | 28 | - | - |
| | Koorki | 7 | 1 | 466 | - | 127 | - | 466 | - | 155 | - | 54 | - | - | 466 | - | 155 | - | - |
| | Awuka | 5 | 1 | 101 | - | 52 | - | 69 | - | 49 | - | 47 | - | 36 | 69 | - | 49 | - | - |
| | Silinke | 9 | - | 124 | - | 25 | - | 146 | - | 127 | - | 48 | - | 15 | 146 | - | 127 | - | - |
| | Total | | | 822 | - | 295 | - | 874 | - | 471 | - | 295 | - | 114 | 874 | - | 471 | - | - |
| | Total 2-5 | | | | | | | | | | | | | | | | | | |
| | G.Total | | | | | | | | | | | | | | | | | | |

monthly EPI vacc.

## E.7. EPI Reporting format with out age break down



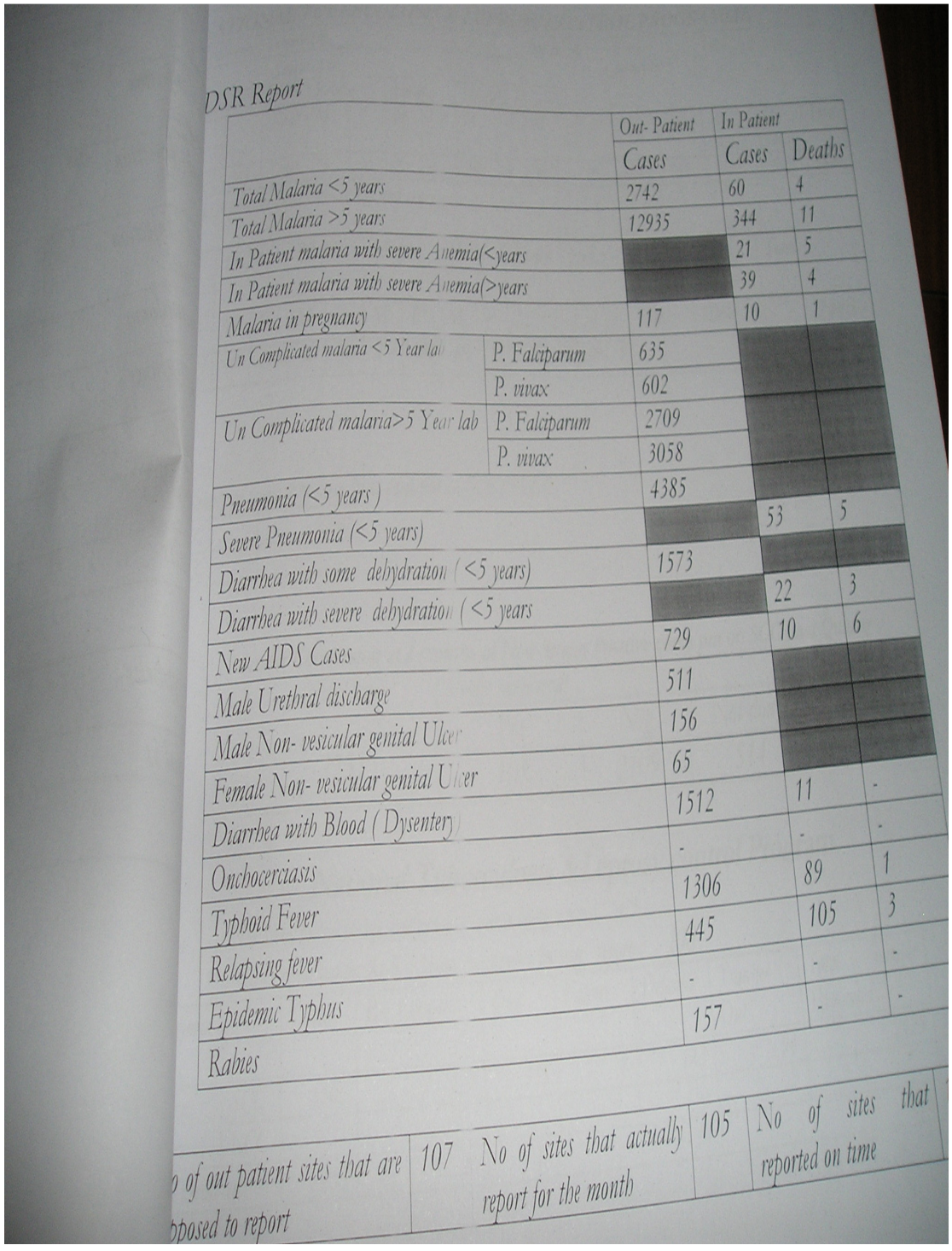
Monthly Health Facility EPI Vaccination Reporting Form (Revised 1994 EC)

Page 1

Zone ____ Woreda ____ Health Facility ____ Month ____ Year ____

| No. | Keble | No. of vaccination sites | | EPI Vaccination given (0-11 months only) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | BCG | Measles | DPT | | | Polio (OPV) | | | | Fully | Vit. A capsule |
| | | Static | Out reach | | | 1 | 2 | 3 | 0 | 1 | 2 | 3 | vaccinated | given |
| | Kebele #1/c | 1 | | 19 | 18 | 19 | 11 | 11 | 19 | 11 | 11 | 8 | 8 | 8 |
| | Kebele #2/c | | | 54 | 38 | 54 | 38 | 34 | 54 | 38 | 34 | 28 | 28 | 28 |
| | Kebele #3/c | 1 | | 5 | 3 | 5 | 10 | 7 | 5 | 10 | 7 | 1 | 1 | 1 |
| | Public clinic | | | 55 | 29 | 49 | 28 | 26 | 49 | 29 | 26 | 32 | 32 | 32 |
| | Arena #1/c | | | 10 | 1 | 10 | 1 | 1 | 10 | 1 | 1 | 1 | 1 | 1 |
| | Arena #2/c | | | 5 | 1 | 5 | 1 | 1 | 5 | 1 | 1 | 1 | 1 | 1 |
| | Arena #3/c | | | 3 | 1 | 3 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 |
| | Selem #1/c | | | 2 | 8 | 2 | 4 | 2 | 2 | 4 | 2 | 2 | 2 | 2 |
| | Selem #2/c | | | 7 | 4 | 7 | 5 | 5 | 7 | 5 | 5 | 4 | 4 | 4 |
| | Gitilo/c | | | 49 | 17 | 49 | 22 | 23 | 49 | 22 | 23 | 17 | 17 | 17 |
| | Total | | | 220 | 126 | 220 | 122 | 122 | 220 | 126 | 122 | 109 | 96 | 96 |
| | Total sites: | 1 | | 44 | 18 | 44 | 27 | 24 | 44 | 27 | 24 | 13 | 13 | 13 |
| | Total all: | | | 155 | 98 | 159 | 83 | 90 | 159 | 93 | 90 | 96 | 96 | 96 |
| | Public all: | | | 17 | 8 | 17 | 6 | 8 | 17 | 6 | 8 | 9 | 9 | 9 |
| | Public c/c | | | 216 | 106 | 220 | 136 | 122 | 220 | 126 | 122 | 109 | 114 | |

## E.8 East Show Zone IDSR Quarterly Report August 2003. (Oromia)



DSR Report

| | | Out- Patient | In Patient | |
|---|---|---|---|---|
| | | Cases | Cases | Deaths |
| Total Malaria <5 years | | 2742 | 60 | 4 |
| Total Malaria >5 years | | 12935 | 344 | 11 |
| In Patient malaria with severe Anemia(<years | | | 21 | 5 |
| In Patient malaria with severe Anemia(>years | | | 39 | 4 |
| Malaria in pregnancy | | 117 | 10 | 1 |
| Un Complicated malaria <5 Year la | P. Falciparum | 635 | | |
| | P. vivax | 602 | | |
| Un Complicated malaria>5 Year lab | P. Falciparum | 2709 | | |
| | P. vivax | 3058 | | |
| Pneumonia (<5 years ) | | 4385 | | |
| Severe Pneumonia (<5 years) | | | 53 | 5 |
| Diarrhea with some dehydration ( <5 years) | | 1573 | | |
| Diarrhea with severe dehydration ( <5 years | | | 22 | 3 |
| New AIDS Cases | | 729 | 10 | 6 |
| Male Urethral discharge | | 511 | | |
| Male Non- vesicular genital Ulcer | | 156 | | |
| Female Non- vesicular genital Ulcer | | 65 | | |
| Diarrhea with Blood ( Dysentery) | | 1512 | 11 | - |
| Onchocerciasis | | - | - | - |
| Typhoid Fever | | 1306 | 89 | 1 |
| Relapsing fever | | 445 | 105 | 3 |
| Epidemic Typhus | | - | - | - |
| Rabies | | 157 | - | - |

| | | | | | |
|---|---|---|---|---|---|
| o of out patient sites that are pposed to report | 107 | No of sites that actually report for the month | 105 | No of sites that reported on time | |

**Appendix F.** Zonal IT Assessment Results in Oromia

The following check list is designed for research purpose that will help to improve Health Management Information System in Oromia Region. The research is part of the implementation of District based Health Information System in the Region.

| Zone Name | How many ICT tools do you have in your Zonal Office? | | | | | Do you have Internet and Networking in Your Zonal Office? Use "**X**" | | | | Numbers of Weredas and availability of electricity and computers in your zone | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Computer | Printer | Photocopy Machine | Fax | Telephone | Internet? | | Networking? | | Weredas | Weredas with out electricity | WHO have computer | Plan |
| | | | | | | Yes | No | Yes | No | | | | |
| East Harerge | 7 | 6 | 1 | 1 | 1 direct line | | X | | X | 16 | 10 2of them GN | 2 | Yes |
| South West Shoa | 4 | 4 | 1 | 1 | 2 | | X | | X | 10 | 2 | 1 | No |
| West Harerge | 4 | 3 | 1 | 1 | 1 | | X | | X | 11 | 5 | | No |
| North Shoa | 3 | 3 | | 1 | 3 | | X | | X | 12 | 2 | 2 | Yes |
| West Shoa | 2 | 2 | 1 | 1 | 3 direct line | X | | | X | 16 | 3 | 6 | Yes |
| Arsi | 5 | 5 | 2 | | 3 | | X | | X | 23 | 6- 6 GN | 5 | Yes |